

सत्यमेव जयते

# Government of India Ministry of Railways

(Railway Board)

# REPORT

OF THE

# Thirty-sixth Meeting

OF THE

# **Locomotive Standards Committee**

January 1956

Issued by Central Standards Office for Railways Chittaranjan (Dist. Burdwan)

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# I. INTRODUCTION

In accordance with the Chief Design Engineer, Central Standards Office, Railway Board's letter No. LSC/XXXVI of the 26th December 1955, to General Managers, Indian Railways, the Locomotive Standards Committee met at Chittaranjan on 19th January 1956 and continued its work until it adjourned on 20th January 1956.

The following Officers attended the Meeting: -

Chairman: Shri P. G. C. Peyton, CME, Western Railway.

Member: ,, J. W. E. Gurr, CME, Central Railway.

,, A. K. Mullick, Dy. CME, Eastern Railway.

,, K. C. Lall, CME, Northern Railway.

" M. M. Khan, CME, North-Eastern Railway.

, B. Venkataraman, CME, Southern Railway.

, P. Rajnath, CME, South-Eastern Railway.

,, E. W. Isaacs, CME, Chittaranjan Locomotive Works.

Secretary: ,, R. Krishnamurti, Chief Design Engineer (Loco), CSO for Railways.

Shri M. V. Kamlani, Deputy Director Research (Mech.), was present at the Meeting as an Observer on behalf of Director Research, Railway Testing & Research Centre, Lucknow.

Shri R. G. Bhatawadekar, Joint Director Research (M&C), Chittaranjan, was present by special invitation during discussion of items No. 17 and No. 37.

To deal expeditiously with the less important subjects a Sub-Committee as per Railway Board's decision (letter No. 52/731/1/M of 30th July 1952) consisting of the Chief Mechanical Engineers, Central and Western Railways, as Members, and the Chief Design Engineer/Loco as Convenor & Secretary, met at Chittaranjan, on 25th and 26th November 1955, and made certain recommendations which were reviewed by the Main Loco Standards Committee.

# II-A. Covering Letter from the Chairman, Locomotive Standards Committee.

· To

The CHIEF DESIGN ENGINEER,

CENTRAL STANDARDS OFFICE FOR RAILWAYS,

CHITTARANJAN.

Dear Sir,

# Report of the XXXVI Meeting of the Locomotive Standards Committee.

I have the honour to submit herewith the Minutes of the XXXVI Meeting of the Locomotive Standards Committee.

Yours faithfully,

(P. G. C. PEYTON)

Chairman,

Dated the 20th January 1956.

Chittaranjan,

Locomotive Standards Committee...



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### Item No. 1.

Subject ... L/AB

Description ... Axlebox details-Keep end plate.

LSC References ... ...

CSO File Ref. ... SL/WP/AB

MD/L/AB of 2-4-55 (382) ER SL/WP AB of 29-7-55 (401) CSO

MD/L/AB.11 of 9-8-55 (404) ER

ML/7/03 of 26-8-55 (405) CLW

Class of Loco Concerned ... ALL LOCOS

Trial No. (If any) ... ...

Agenda ... TO CONSIDER REVISED DESIGNS OF KEEP END-

PLATE FOR COUPLED AXLEBOXES OF WP/WG LOCOS FITTED WITH AJAX LUBRICATORS SHOWN IN CSO SKETCHES NOS. L-363, 364, 365 &

366.

Notes by Secretary

Alternative designs of axlebox keep end plate, to be manufactured either in cast iron or from steel plate, are shown in CSO Sketches quoted. The designs provide for adjustment to meet the reduction in journal diameter and thickness of axlebox crown due to wear.

# Committee's Recommendation.

Para 1. The Committee recommend that the Fabricated design of axlebox keep endplates shown in CSO Sketches L-365 and L-366 should be adopted as standard and the cast iron designs shown in CSO Sketches L-363 and L-364 as Permissible Alternatives.

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Railway Boards' Orders-

· Para 1. Approved.

### Item No. 2

Subject ... L/AB

Description ... Axlebox Details (Hot Boxes).

LSC Reference ... XXXV-2.

CSO File Reference ... SL/HB

Class of Loco concerned ... All.

Trial No. (If any) ... ... ...

Agenda ... TO REVIEW THE REPORT SUBMICTED BY THE

CME SRIy. ON LOCOMOTIVES HOT BOXES FOR

THE YEAR ENDING MARCH 1955.

# Notes by Secretary

The report from the CME/SRly. is awaited and will be tabled at the meeting for consideration.

### Committee's Recommendation.

Para 2. The Hotbox report for the year ending March 1955 tabled by the SRly. was reviewed. It was noted that the compilation lacked reliability because, according to the reporter, the organisation available at present was not capable of undertaking this task satisfactorily and also due to the data not being gathered under sufficiently detailed headings. After discussion, the Committee recommends that:—

- (a) It is necessary to continue gathering such statistics, which are very important for maintenance and design.
- (b) The compilation of the statistics should be handled by the Research Directorate as being the appropriate central organisation for such work.
- (c) The data to be collected should be confined to all X, W and Y class locos other than shunting, the 4-6-0 and --8-0 BESA, A/CWD, AWE and MAWD locomotives
- (d) The data should include roller bearing axleboxes.
- (e) The proforma should be evolved by the Research Directorate.

# Railway Board's Orders

Para 2. (a, c & d) - Noted.

(b & e)—This work will be undertaken by J. D. (Coal) under D. M. E., Railway Board.

# Item No. 3.

Subject	•••	L/AN.			
Description	•••	Ashpan details.			
LSC References	•••	. <del>-</del>			
CSO File Reference	•••	SL/WP/AN			
		M. 104 RL 27 of 28.7.55	(63)	CR	
		M. 104 RL 27 of 20.8.55	(64)	CR	
		494. M/6/AN(M. VII) of 2.9.55	(66)	NR	
		M/DL/FG/WP of 7.9.55	(67)	SR	
Class of Loco concer	ned	WP/WG.			
Trial No. (If any)					
Agenda	•••	TO CONSIDER THE MODIFIED DESIGN OF HOLD DOOR OPERATING ROD JAW AND DUST COVE CSL DRAWING NO. 2461 ALT. 1.			

Notes by Secretary.

The Chief Mechanical Engineer, Central Railway, has reported a case where the ashpan damper pull rod of a WP engine came adrift and caused a serious derailment. CSL Drg. No. 2461 Alt. 1 shows a modified arrangement whereby the fork end has been formed by bending a single plate instead of a welded construction.

# Committee's Recommendation.

Para 3. The Committee recommend acceptance of the modified design of hopper door operating rod fulcrum end for WP/WG locomotives as shown in CSL Drawing 2461 Alt. 1.

Railway Board's Orders.

Para 3. Approved as future standard.

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### Item No. 4.

Subject ... L/BE

Description ... Bogie, Pony and Radial Truck details.

LSC References ... XXXIV-54

CSO File References... ... SL/YG/FT

SL/YG, FT of 16-6-54 (8) CSO.

M. 110/11/8 of 2-8-55 (21) WR...

Class of Loco concerned. ... YG/YL

Trial No. (If any) ... —

Agenda ... TO RECORD CSL DRG. 2146 ALT. 2 SHOWING

MODIFIED LUBRICATION ARRANGEMENT OF FRONT TRUCK CENTRE PIN OF EXISTING YG/YL LOCOS, AND CSO SKETCHES L-326 AND L-290, FOR FUTURE

BUILDS OF YG & YL LOCOS RESPECTIVELY.

Notes by Secretary.

Railways have pointed out the difficulty of welding the steel ring (Item B, CSL Drg. No. 2146) to the cast iron centre pin seat as approved vide para 54 of the Minutes of the XXXIV LSC Meeting. CSL Drg. 2146 Alt. 2 shows a revised arrangement eliminating theneed for welding on existing YG & YL locomotives.

CSL Sks. L-326 and L-290 show the arrangement for future builds.

# Committee's Recommendation.

Para 4. The Committee recommend approval of the method of lubrication of the front truck centre pin shown in CSL Drawing 2146 Alt. 2 for existing YG and YL locomotives and the arrangement shown in CSO Sketcles L-326 and L-290 for new builds on YG and YL locomotive respectively.

Railway Board's Orders.

Para 4. Approved.

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## Item No. 5.

... L/BE-TE. Subject

Bogie, Truck details (Friction Liners) Description

XXI-89, XXII-20 & 122, XXIX-107. LSC References

...

SL/OSL/1 CSO File Ref.

Noting at p.21/n dated 19.9.51

LSC/XXXVI

MC 1/1 of 1.11.55 (20)RTR&C

Class of Loco Concerned. Trial No. (If any) ...

CSO

Agenda

TO REVIEW THE RESULTS OF TRIALS WITH VARIOUS BRANDS OF FRICTION FABRICS MATERIALS.

Notes by Secretary.

In pursuance of of French Expert Committee's recommendations and Railway Board's orders on Para 2 (1) of the Minutes of the Special Truck & Loco Standards Committee Meeting held in July 1951, the Research Directorate have carried out tests with RAILKO AL. 2 and MINTEX R. I friction fabric liners and submitted as note on this subject (Appendix I) The Committee may review the results of these tests and consider the desirability of using Railko AL. 2 brand of friction fabric liners as originally fitted on WP locos, pending conclusion of the research scheme.

### Committee's Recommendation

Para 5. The Committee recommend that for the present, pending results of research, only Railko AL. 2 brand of liners should be specified.

The Committee consider, however, that as this subject has been under investigation by the Research Directorate, since January 1951, it should be expedited by CSO in conjuction with Research Directorate and a final decision arrived at, if possible, at the next LSC

Railway Boards's Orders.

Para 5. Pending conclusion of research on friction liners, Railko AL-2 brand of friction fabric liner should be used by Railways

# Item No. 6.

L/BM Subject

Boiler Mountings, Washout Plug, Etc; Description

XXV-1, XXX-4&5, XXXI-5 to 7, XXXII-56, XXXIII-4, LSC References

XXXV-12.

SL/FXS CSO File Reference ...

SL/FXS of 19.4.55 (786)CSO

WG Class of Loco concerned TLA 5.2 Trial No. (If any) ...

TO REVIEW REPORTS OF TRIALS WITH CANADIAN Agenda

DESIGN OF WASHOUT PLUG SEATING ON LOCOMO-TIVE BOILERS.

Notes by Secretary.

This subject was discussed at the XXXV LSC Meeting and it was decided, vide para 12 of the Mintues of the meeting to carry over the subject. The trial reports, if received, may be reviewed by the Committee.

# Committee's Recommendation.

Para 6. The Committee note that trials with the Canadian design of washout plug have proved satisfactory. In view, however, of the acceptance of the two-way washout plug by the XXXII LSC, the Committee do not recommend that the Canadian design should be adopted as standard.

Railway Board's Orders.

Para 6. Approved. Trials with Canadian type of washout plugs should be discontinued.

# Item No. 7

Subject ... L/BM Boiler Mountings-Washout Plugs. Description

XXX-2, XXXI- 11, XXXII-3

CSO File Ref. ... SL/WP/BRM.

> MD/L/BM of 3. 11. 54 & replies thereto (90) ER

(108) CSO

SL/WP/BRM of 8-12-55 to Railways

Class of Loco Concerned.

... All.

Trial No. (If any)

LSC References

Agenda

TO REVIEW WASHOUT AND INSPECTION FACILITIES ON IRS LOCOMOTIVE BOILERS.

Notes by Secretary-

The Committee may express views on the recommendations of the representatives of various Railways who held a meeting in CSO, Chittaranjan, on 20-12-55, to discuss and ascertain the utility of inspection and washout facilities already existing on IRS boilers. (Appendix II)

## Committee's Recommendation

Para 7. The Committee reviewed the proposals made by the Boiler Inspectors and recommend the following :-

- (i) Smokebox Tube Plate.—The two washout plugs at the top sides be replaced by two plugs between the flues and smoketubes.
- (ii) 1st Barrel.—A cooling plug ahead of the clackbox should be provided and the mud door in the vicinity be eliminated.
- (iii) Hind Barrel Course.—The inspection door should, as for as possible, be located above the top row of flue tubes. In the case of WL boilers, the inspection door may be located on the right hand side.
- (iv) Outer Firebox Throat Plate. Subject to design restrictions the mud doors should be located in the corner of the flange as high as possible.
- (v) Outer Firebox Wrapper Plate. -For future builds, the CSO should, as for as possible, specify Inspection Doors in lieu of mud doors. Additional doors, as indicated in CSO's comments, should be provided.
- (vi) Firebox Backplate.—Mud doors in the mid section of the corner of the flange should be specified for future builds.
- (vii) Rearrangement of Spark Arrestor Netting in the Smokebox. —The present arrangement is unsatisfactory and CSO should investigate the possibility of developing a better design for ease of handling.
- (viii) Cab Fioor Plate.—CSO should alter the cab floor plates so as to facilitate easy access to the washout plugs at the rear corners of the foundation ring.
  - (ix) Washout Plug Seatings.—The cast seating should be replaced by a stiffening plate. The plug should be screwed into the stiffening plate only.
  - (x) Copper Ferrules and beading of Tubes. -The existing specification should continue for new builds.
  - (xi) Axis of Doors.—As the new doors are fitted in circular seatings, the axis of the doors may be horizontal.

# Railway Board's Orders-

Para 7. i, ii, iv, v, viii approved.

CSO to specify on new builds.

Modifications to existing boilers should be carried out as and when considered necessary by Railways.

iii, vi, ix and xi approved. CSO to specify on new builds.

vii - CSO to investigate.

x-Noted.

## Item No. 8

... L/BR "Subject ... L/AN . . . Boiler details-Breather Plate. Description LSC References CSO File Reference SL/WP/BR **CSO** SL/WP/BR of 12-9-55 (64)Class of Loco Concerned WP/WG ... Trial No. ( If any ) ...

Agenda

TO CONSIDER MODIFICATIONS TO THE BOILER BREATHING AND DEFLECTION PLATES AND ASHPANS OF WP/WG LOCOS, AS SHOWN IN C3L DRGS. NOS. 2458 & 2459. Alt. 1.

Notes by Secretary.

Railways have Reported cracking of the hind breather plate of WP/WG Locomotives. CSL Drgs. Nos. 2458 and 2459 Alt 1 have been prepared showing increased section of the breather plates and an arrangement to minimise the possibility of ash accumulating between the hind drag casting and breather plate.

# Committee's Recommendation.

Para 8. The committee recommend that the design shown in CSL Drawing 2458 should be adopted for future builds with the following alterations:

- (i) Item D & F to be eliminated.
- (ii) The 1½" x 1½" x ½" angle iron should be rivetted to the breathing plate instead of being welded.
- (iii) The \*" radius at the corners of 7 %" gap in the top centre of the breathing plate should be increased to the maximum possible extent.

Para 9. In conjunction with the above, the Committee recommend that the same side clearance between the firebox support and frame cradle casting as on WG locomotives, should be adopted on WP locomotives also

Para 10. The Committee also recommend acceptance of the modification to the existing WP/WG ashpans as shown in CSL Drawing 2159 Alt. 1 On new ashpans, the required openings for the grate pull rods should be arranged without the need for an auxiliary cover plate.

Railway Board's Orders.

Para 8. Approved. CSO to issue revised drawings. Railways should follow the revised design when replacements of existing hind breather plates are necessary.

Para 9. Approved.

Para 10. Approved.

### Item No. 9

L/BR Subject Boiler details Brace feet. Description LSC References S. No. SL/WP/BR CSO File Ref SL/WP/BR of 2, 2, 11955, and (CSO) 28% replies there to ... WP/WG. Class of Loco Concerned Trial No. (If any) ... ... TO CONSIDER MODIFIED DESIGNS OF BRACE FEET Agenda BOILERS SHOWN IN IR PART WP/WG DRAWINGS NOS. L/BR--742, 745 & 746

Notes by Secretary.

Railways have reported cases of fractures of the brace feet attaching the brace rods at the firebox end of WP boilers.

IR Part Drawings No. L/BR—709, 712, 724, 727, 742, 745 and 746 have been prepared showing reinforced designs of brace feet and rods for the smokebox and firebox ends.

These may be approved for future use-

### Committe's Recommendation --

Para 11. The Committee recommend that :-

- (i) Brace feet to IR Part Drawing L/BR-742, 745 and 746 be applied to existing WP/WG boilers as they pass through shops for POH, and to future builds.
- and (ii) Brace rods to IR Part Drawings L/BR-709, 712, 724 and 727 be adopted for future builds and on existing boilers whenever renewals are necessary.

Railway Board's Orders-

Para 11. Brace feet to IR Part Drgs. L/BR-742, 745 and 746.

Should be fitted on new boilers during construction, and all brace rods at firebox end should be 1½" in diameter in accordance with IR Prat Drgs. L/BR—724 to 737 and L/BR 709 to 722.

Regarding replacement of brace feet on existing boilers the following orders will apply:—

- (i) On the boilers fitted to 16 WP/P and 300 WP locomotives and all the spare boilers obtained along with these locos from USA., the existing brace feet at locations 'G' and 'K' of \*Drawing E/SL-126/90 should be replaced with new brace feet to IR Part Drg. L/BR-742 as and when boilers are overhauled in Railway worksops.
- (ii) Re boilers of WG locomotives and of latter builds of WP locomotives, the brace feet at the above locations should be removed from two boilers of each contract, both WP and WG, and critically examined for the existence of 1" radius at the junction of the eye and the palm as shown in Ref. Letter 'F' Drawing E/SL—126/28 and Ref. Letters 'E' and 'F' of \*Drawing E/SL—127/121 for WP and WG locos respectively. And for the presence of stress raisers and cracks. This requirement shall be observed by Raiways as boilers of each of the contracts pass through workshops and reports of such examination should be submitted to the C.S.O., who will decide in consultation with the Board whether the renewal of the existing brace feet on the boilers of a particular contract is necessry.

<sup>\*</sup>Not printed in this report.

### Item No. 10

			LOCOMOTIVES.	
Agenda			TO STANDARDIŞE THE CAB SHUTTERS	FOR IRS
Trial No. (If any).	•		_	
Class of Loco Concer	ned		All standard locomotives.	
			494-M/6/56(M-IV) of 14-9-53	(167) NR.
			M.104 RL.22 of 15-4-53	(154) CR.
			M.110/1/1 of 26-2-53	(146) WR.
1 1			M/51/6 of 23-2-53	(145) NER.
			D/CB of 13-2-53	(144) ER.
			SL/CB of 5-2-53.	(142) CSO
CSO File Ref.			SL/CB	
LSC References			<del>-</del>	
Description	- • •	•••	Cab details (Engine & Tender) Cab windows.	
Subject	***	• • •	L/CB	

Notes by Secretary.

Recommendations of Railways for a suitable design of locomotive cab shutter in order to eliminate loss in service and reduce maintenance indicate preference to one of the following types:—

- (i) Steel louvres in wooden frame
- (ii) Wooden louvres in wooden frame
- (iii) Wood panels in wooden frame.

The standard on coaching stock is a wooden shutter with steel louvres.

# Committee's Recommendation.

Para 12. The Committee recommend that an aluminium shutter fitted with aluminium louvres should be adopted as future standard.

Railway Board's Orders.

Para 12. This subject was brought up due to loss of steel louvered shutters. It is not understood how the aluminium shutters will overcome this difficulty; as such the existing standard may remain.

# Item No. 11

Subject	•••	٠	L/CG		
Description	•••	•••	Clothing details—Streamlining.		
LSC References		•••	<del></del>		
CSO File Ref.	•••	400	SL/WP/EE & SL/WP/Streamlining.		
			MD/L/ML of 23-9-54 & replies thereto	(128)	ER
			MD/L/CG of 14-6-55	(75)	ER
			SL/WP/Streamling of 27-6-55 and		
			replies thereto	(76) •	cso
Class of Loco concerned			WP		
Trial No. (If any)	•••	•••	_		
Agenda		•••	TO CONSIDER THE REMOVAL OF THE "B STREAMLINING AT THE SMOKEBOX F WP LOCOMOTIVES, AND THE RELOCA ELECTRIC HEADLIGHT.	RONT EN	D OF

# Notes by Secretary.

Railways have reported rapid deterioration of the electric headlight cables in the enclosed space between the smokebox door and streamlined bullet nose of WP locomotives. The Committee may consider the following proposals:

- (a) Removal of front end streamlining and relocation of the electric headlight in the conventional manner,
- or (b) Leading the electric cable on the outside of the streamlining as shown on \*Eastern Railway Sk. 1532-54 and providing slots near the circumferential edge of the bullet nose to afford ventilation.

# Committee's Recommendation.

Para 13. The Committee recomment that the "bullet nose" streamlining at the smokebox front end of WP locomotives should be retained, and in order to increase the service life of the electric wiring, ventilating slots should be made in the "bullet nose" and the electric wiring should be covered with heat-resisting insulation.

# Railway Board's orders.

Para 13. Approved.

\*Not printed in this Report.

## Item No. 12

... L/EQ Subject Oil Lamps, Tools, Speedometers, etc. Description ... XXXIII 61-65 XXXV 32. LSC References SL/SPR CSO File Ref. CSO SL/SPR of 9-4-55 (465)M.265-S-25 of 12-5-55 (469)CR MD/L/SPR/Trial of 13-9-55 (478)ER Class of Loco concerned WPTrial No. (If any) ... TO REVIEW REPORTS OF PERFORMANCE OF DEUTA-Agenda WERKE SPEED RECORDING EQUIPMENT ON TRIAL

Notes by Secretary.

Messrs. Deuta-Werke have recently offered instruments of an improved design in replacement of the recorders which they had already supplied for trial purposes. The reports of Central and Western Railways, on the working of the new instruments, have not yet been received.

# Committee's Recommendation.

Para 14. The Committee note that the trials with Deuta Werke WR-2 Speed Recorders supplied to the Central and Western Railways have proved unsatisfactory.

Replacement speed recorders are now being supplied and the Central and Western Railways should submit reports on their performance.

Railway Board's Orders.

Para 14. Noted.

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# Item No. 13.

Agenda		TO CONSIDER THE MODIFIED DESIGN CLIPS FOR BAR FRAME LOCOMOTIVES A		AME
Trial No. (If any)		_		
Class of Loco Concerned	•••	WP/WG		
		M. 120/2/1 of 8.10.54	(75)	WR
		M/DL/FR/WG of 24.9.54	(74)	SR
		M 381 RL 2 of 16.8.54	(69)	CR
		D/L/FR of 31.3.54	(50)	ER
		SL/WP/FR of 23.2.54.	(48)	CSO**
		M 381 RL 2 of 5.2.54	(47)	CR
		MS. 428 of 23.11.53	(45)	ER
CSO File Ref	•••	SL/WG/FR & noting p. 36/n.		
LSC References	•••	-		
Description	••	Frames—Frame Clips		
Subject	• •••	L/FR		

CSO SKETCH NO. L-354.

Notes by Secretary.

Investigations into the fracture of Bar frame clips on WG class locomotives reveal that the method of manufacture by oxycutting and the small radii at the corners are contributory causes to the failures. Clause 54 of I R S. Specification R. 32-54 has been suitably amended requiring this item to be forged and heat treated, so as to ensure proper grain flow.

CSO Sk.L-354 shows increased radii at the corners of the Bar frame and frame clips of WP/WG locos to reduce stress concentration. This sketch will apply to future builds.

# Committee's Recommendation.

Para 15. The Committee recommend that the modified design of frame clip, shown in CSO Sk. L-354, should be adopted as standard for WP/WG class locomotives and that a similar design should be evolved for other Bar frame locomotives.

Railway Board's Orders.

Para 15. Approved. CSO to issue similar drawings for YP, YG & WL class locomotives.

### Item No. 14.

... L/FR. Subject Description Frames.

LSC References

CSO File ref.

... SL/YG/FR

M/DL/FR/YG/YP of 29.6.54

SR. (1)

and comments from other Railways there on.

SL/YP/FR.

Class of loco Concerned

YP/YG.

Trial No. (If any)

Agenda

TO CONSIDER THE METHOD OF STRENGTHENING THE FRONT END OF YP CLASS LOCOMOTIVE BAR FRAMES SHOWN IN CSL DRAWING 2481.

# Notes by Secretary.

\* CSL Drawing 2481 shows the method of strengthening the front end of YP locomotive bar frame to allow for undue buffing shocks, as cases have been reported of the front end bending under collision.

# Committee's Recommendation.

Para 16. Since the cases reported of YP frames bending at the front end have been due to collision, the Committee recommend no change in the present design.

# Railway Board's Orders

Para 16. Noted.

\* Not printed in this report.



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### Item No. 15.

Subject ... L/FR

Description ... Frames-Cattle guard.

LSC References ... ... XXXIV-22.

CSO File Ref. ... SL/WP/FR/1

SL/WP/FR/1 of 1.10.53 (75) CSO D/L/FR of 18-3-54 (80) ER

Class of Loco. Concerned. ... All.

Trial No. (If any) ... ... ...

Agenda ... TO CONSIDER THE PROVISION OF 'BALLAST SWEEP' ON LOCOMOTIVE CATTLE GUARDS.

# Notes by Secretary.

The provision of a ballast sweep was considered, vide para 22 of the Minutes of the XXXIV LSC Meeting. The design shown in \*CSO Sketch L-221 has been commented upon unfavourably by the Eastern Railway. The Committee's attention is drawn to the fact that the design shown in CSO Sketch L-113 Alt. 1 has proved fairly efficient except that the impulse of the blow on the ballast at high speeds results in bending the cattle guard itself. It is, therefore, evident that irresspective of the type of ballast sweep the present design of cattle guard is not strong enough. The Committee may review the need for a ballast sweep and decide whether further trials should be carried out.

### Committee's Recommendation.

Para 17. The Committee consider that the cattle guards of WP locos are not strong enough to withstand the impact of the ballast striking the sweep. The Committee recommend that CSO should prepare a design of strengthened cattle guard, and further trials should be carried out by the Central and Eastern Railways with ballast—sweep to CSO—Sketch L-113 Alt. 1, or any other alternative.

# Railway Board's Order.

Para I7. CSO should prepare a revised design of strengthened cattle guard, and further trial should be carried out by Research Directorate on the Central and Eastern Railways.

\* Not printed in this report.

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# Item No. 16.

"Subject		•••	L/FX		
Description	•••		Firebox details-Thermic Syphon,		
			Security Circulator Tubes.		
LSC References	•••	•••	•••		
CSO File Ref.	n44	. * * #	SL/FXS/III		
			D. O. No. M. 110/1/2 of 4.3,55	(14)	WR
			D. O. No. SL/FXS of 24.3.55	(15)	CSO
		4	M. 110/1/2 of 9.5.55	(18)	WR
			SL/FXS/III of 5.6.55	(21)	CSO
Class of Loco Cond	erned	•••	WG		
Trial No. (If any)	•••	•••	•••		
Agenda			TO NOTE CSL DRA WINGS 2435, 24 ING MODIFICATIONS BEING MADE TIVE BOILERS FOR COMPARATION	TO WG	LOCOMO-

Notes by Secretary.

In order to obtain necessary data for comparing the performance of boilers fitted with thermic syphon against boilers fitted with security arch tubes only, the Research Controlling Committee, at its second meeting held in Delhi on 8-2-55, decided that one WG boiler to be built by Chittaranjan Loco. Works be fitted with security arch tubes only (Item 4-Scheme MB.05 of Minutes). †CSL Drgs. Nos. 2435, 2433 and 2437 show the necessary modifications for this purpose on the WG boiler.

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& WITHOUT THERMIC SYPHONS.

# Committee's Recommendation.

Para 18. Noted.

Railway Board's Orders.

Para 18. Noted.

\*Not printed in this report.

### Item No. 17.

Subject	***	•••	L/FX			
Description	***	•••	Firebox details.	***		
LSC References	***					
CSO File Ref.	***	•••	SL/YG/FXS.	***		
			M. 268/4/4/5 of 15-10-55	****	(48)	WR
			LSC/XXXV1 of 8-11-55		(49)	CSO,
			SL/YP/FXS.			
Class of Loco conc	erned					
Trial No. (If any)	•••	***	· ·			
Agenda		•••	TO CONSIDER REMEDIAL CRACKING ON YP/YG BOILE	MEASURES R FIREBOX I		AVOID.

Notes by Secretary.

The following measures are considered necessary to overcome the defects experienced on YP/YG steel fireboxes:-

- (a) Adoption of butt welding at the joint between the throat plate diaphragm and the tubular neck of the syphon in preference to fillet weld, which has poor fatigue strength and is the main cause of cracks developing at this region;
- (b) Provision of a separate diaphragm plate to avoid cracking in the plate close to the weld;
- (c) Addititional washing out facilities to clean the inside of the syphon and to avoid overheating and consequent development of cracks in the body of the syphon;
- (d) Proper setting of the firebox back plate to the foundation ring prior to the welding of the plate to the wrapper plate in the lower region in order to eliminate cracking at the bottom corners, and also increasing the thickness of the back plate from \( \frac{3}{8}'' \) to 13/32'';
- (e) Inspection of flame-cut edges and drilled holes in order to detect the existence of lamination and adopting a policy to purchase the firebox plates from reputed firms who have controlled internal inspection;
- (f) Limiting the carbon content of the firebox plates to the maximum permitted in IRS Specification R. 29 in order to avoid the effect of cold working on certain areas in the plate;
- (g) Adoption of the internal dosage system of water treatment to eliminate corrosional fatigue, effect of Ion and oxygen concentration cells, and electrolytic conditions. The use of tannin would assist in the removal of oxygen which causes pitting and corrosion in isolated areas.

The Committee may consider the above views and recommend remedial measures to be taken in order to obtain improved service with steel fireboxes.

# Committee's Recommendation.

Para 19. The Committee endorse the action taken by the CSO in eliminating the cracking of the steel fireboxes at various locations and also recommend that Railways experiencing trouble with steel fireboxes should introduce water treatment in consultation with the Director, Research.

Railway Board's Orders.

Para 19, Noted.

# Item No. 18.

Subject ... L/IR

Description ... Injector and Injector Gearings.

LSC References ... ... -

CSO File Ref. ... SL/WP/IR

SL/WP/IR of 20-9-54 (89) CSO and replies thereto.

Class of Loco concerned ... WP/p

Trial No. (If any) ... —

Agenda ... TO CONSIDER THE SUBSTITUTION OF NATHAN INJECTORS BY SIMPLEX INJECTORS ON WP/p LOCOS.

Notes by Secretary.

In the interests of standardization, Nathan injectors may be replaced by standard Simplex injectors on WP locomotives. CSL Drawings 2416 & 2417 show the method of fitting the Simplex injectors to WP/p locomotives.

# Committee's Recommendation.

Para 20. The Committee recommend the substitution of the Nathan injectors on WP/p locomotives.

Railway Board's Orders.

Para 20. Approved.

Item No. 19.

Subject ... L/LB

Description ... Lubricator

LSC References ... -

CSO File Ref. ... SL/LB

WF: MSE of 6-11-52 (369) Wakefield Co. SL/LB of 17-6-53. (409) CSO. AM: MSE of 14-8-53 (427) Wakefield Co. SL/LB of 13/8-54 (465) CSO.

ML/R/8734 & 8735WG of

26-7-55 (548) CLW.

Class of Loco concerned ... WG

Trial No. (If any) ... —

Agenda ... TO NOTE TRAILS BEING UNDERTAKEN ON WG LOCO-

MOTIVES FITTED WITH WAKEFIELD'S CONVERGENT JET ATOMISERS TO COMPARE WITH THE STANDARD METHOD OF LUBRICATION CONNECTION TO THE

STEAM PIPE.

Notes by Secretary.

Messrs. C.C. Wakefield & Co. claim that with the use of their Convergent Jet Atomiser, oil carbonisation and wear in locomotive steam cylinders and valve liners will be reduced. The Atmoisers have been fitted on two WG locomotives built by the Chittaranjan Loco. Works for trial purposes, in order to obtain comparative data.

# Committee's Recommendation.

Para 21. Noted.

Railway Board's Orders.

Para 21. C. S. O. to issue a trial form,

### Item No. 20.

Subject		•••	L/MN		
Description	•••	•••	Motion details.		
LSC References	•••	•••			
CSO File Ref.	•••	•••	SL/YP/MN L/202/GL of 5-8-54 SL/YP/MN of 10-9-54 & replies thereto. M/DL/MN/YP of 13-7-55 SL/YP/MN of 19-8-55	(3 <sup>0</sup> ) (31) (69) (70)	SR CSO SR CSO
Class of concerned	•••		YP/YG		
Trial No. (If any)	•••	•••	_		
Agenda		••• >	TO CONSIDER THE REVISED DESIGNS OF RODS, COMBINATION LEVERS, ECCENT LIFTING LINKS OF YP/YG LOCOMOTIVIN IR PART DRAWINGS L/MN-696 L/MN-701 and L/MN-702.	RIC RODS	S AND HOWN

Notes by Secretary.

I,R. Part Drawings L/MN-696, to L/MN-699, L-MN-701 and L/MN-702 have been prepared showing increased sections of motion gear components on  $\rm YP/YG$  locomotives. This is necessary as the original designs were in higher tensile strength steel to AAR Specifications, whereas the I.R. Standard is to use Class I Steel.

# Committee's Recommendation.

Para 22. The Committee recommend adoption of the revised design of valve gear components shown in IR Part Drawings L/MN-696 to 699, 701 & 702, for YP/YG locomotives.

Railway Board's Orders.

Para 22. Approved for future standard and for adoption where renewals are necessary.

# Item No 21.

Agenda			TO CONSIDER THE ADOPTION	(
Trial No. (If any)	•••	•••	_	
Class of Loco concerned		•••	ALL IRS	
CSO File Ref	•••		SL/RB.	
LSC References	•••		XXVI-74, XXXII-44.	
Description	•••		Motion details-Eccentric Rod.	
Subject	•••		L/MN	
			E 45 C - 1 C C C C C C C C C C C C C C C C C	

... TO CONSIDER THE ADOPTION OF TIMEN ROLLER BEARINGS FOR THE CRANK END OF ECCENTRIC RODS, AS A PERMISSIBLE ALTERNATIVE.

Notes by Secretary.

30 WM locomotives obtained in 1951-52 and 120 WP locomotives built in Canada under the Colombo Plan have been fitted with Timken roller bearings at the crank end of eccentric rods- So far, no complaint has been received on the performance of these bearings and the Committee may consider the inclusion of Timken bearings as a permissible alternative to the SKF roller bearings for this application on future builds.

# Committee's Recommendation

Para 23. The Committee recommend that, in view of the unsatisfactory service of the SKF roller bearing, on the eccentric rods of IRS locomotives, this make should not be fitted on future builds.

The Timken roller bearing, which has proved satisfactory on WM class locomotives, should be adopted as the future standard.

Railway Board's Orders.

Para 23. Pending further experience with the direct mounted SKF Roller Bearings on YL & WL class locomotives, Timken Bearings only should be specified for the return crank end of eccentric rods.

## Item No. 22.

*Subject	•••	L/MN	
Description		Motion datails.	
LSC References	•••	-	
CSO File ref	***	SL/OPR	•
		55/509/1/M of 24.2.55	(8) Rly. Bd
		n n n	(9)
		SL/OPR of 12.8.55 and replies there to.	(10) CSO.
Class of loco Conce	erned	All IRS	
Trail No. (If any)		•••	*
Agenda	•••	TO CONSIDER TRIALS OF CASE-HARD PINS WORKING IN CASE-HARDENED ON IRS LOCOS.	ENED MOTION STEEL BUSHES

Notes by Secretary.

The Railway Workshop Reviewing Committee in Para 10 of their 2nd Interim Report have recommended the use of case-hardened steel pins in case-hardened bushes on valve motion parts, on the basis of satisfactory reports on American Railroads.

The views of Railways may be considered by the Committee.

# Committee's Recommendation.

Para 24. The Committee recommed that in view of the satis-factory report from the Southern Railway, trials should be carried out on all Railways with case-hardened motion pins working in case-hardened bushes.

Railway Board's Orders.

Para 24. Trials should be carried out on each Railway on 6 passenger and 6 Goods locomotives (on both Broad & Metre Gauges.) C.S.O. will issue the trial form.

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			Item No. 23		
Subject	•••	•••	L/CL		
Description	•••	•••	Oil Boxes, Oilcups & Covers.		
LSC References					
CSO File Ref	····		SL/WP/CL IL/CWD/OC MD/L/OC of 14.6.55 M. 104 RL 1 of 16.7.55	(207) (208)	ER CR
Class of loco Concer	ned	•••	WP		
Trial No. (If any)	•••	•••		,	
Agenda	•••	•••	TO CONSIDER THE ADOPTION OF OIL BOXES IN L OF OILCUPS FOR SLIDE BAR LUBRICATION ON LOCOMOTIVES AS SHOWN ON CSL DRG. NO. 2465.		

Note by Secretary.

Railways have reported cases of oilcups fitted to the slide bar of WP locomotives fracturing at the neck, and the oil cup covers falling off in service. Some Railways prefer replacement of oil cups by oil boxes fitted to the guide bearer plate and with oil pipes leading into the top slide bar. This arrangement is shown in CSL Drg. 2465.

# Committee's Recommendation.

Para 25. The Committee recommend the provision of oil boxes for slide bar lubrication of IRS locomotives on the line shown in CSL Drawing 2465, except that the boxes should be secured by bolts instead of studs where possible.

Raiway Board's Orders.

Para 25. Approved. CSO to issue necessary drawings.

# Item No. 24

Subject ... L/PK

Description ... Piston Rod & Valve Spindle packing-Swab boxes.

LSC References ... XXX-52

CSO File Ref. ... SL/WP/PR

SL/WP/PR of 14-6-55 (171) CSO,...

and replies thereto.

Class of Loco concerned ... IRS

.

Trial No. (If any) ... -

Agenda ... TO CONSIDER THE STANDARDISATION OF SWAB

BOXES FOR PISTON ROD LUBRICATION ON IRS LOCO-

MOTIVES.

Notes by Secretary.

Since C. I. Swab Boxes are reported to break in service, a fabricated design may be considered as an alternative, as recommended by certain railways.

# Committee's Recommendations.

Para 26. The Committee recommend that a single piece fabricated design of Swab-box should be adopted as standard.

Railway Board's Orders.

Para 26. Approved. CSO to issue necessary drawings.

Item No. 25.

Subject ... L/PX

Description ... Piston rods, Crosshead, etc.

LSC References ... ... XXXIV-39, XXXV-52

CSO File Ref. ... SL/WG/CH of 30-3-55 (48) CSO<sup>3</sup>

Class of Loco Concerned ... WG

Trial No. (If any) ... \_\_ TLF 2.3

Agenda ... TO REVIEW REPORTS OF TRIALS WITH MODIFIED DOUBLE TAPER FORM OF PISTON ROD-CROSSHEAD CONNECTION SHOWN IN \*CSO SK.L. 233 Alt. 1.

Notes by Secretary.

The report from The Chief Mcchanical Engineer, Central Railway, if received, may be considered by the Committee.

# Committee's Recommendation.

Para 27. The Committee recommend that the subject should be carried over to thenext meeting as trials are not yet complete.

Railway Board's Orders.

Para 27. Trials should be expedited.

\*Not printed in this Report.

### Item No. 26.

... L/RB Subject

... Roller and Pall bearings. Description

XXIX-70, XXX-101, XXXI-76, XXXIII-47, XXXIII-46, LSC References --,

XXXV-53,

... SL/RB. CSO File Ref.

(483)SL/RB of 5-4-55

CSO. 2499/53449 of 30-11-55 (500) SE

Class of Loco, Concerned. ... WG.

... TLL 3.4 Trial No. (If any)

... TO EXAMINE COMPARATIVE PERFORMANCE OF SKF, Agenda

> TIMKEN AND HOFFMANN ROLLER BEARING AXLE-BOXES FITTED TO CARRYING WHEELS OF WG LOCO-

MOTIVES.

Notes by Secretary.

Trials for a further period of 12 months were required to be conducted, vide Para 53 of the Minutes of the XXXV LSC Meeting. Reports from Central and Eastern Railways, if received, may be considered by the Committee.

## Committee's Recommendation.

Para 28. From a study of the trial reports submitted by Railways and the note tabled by the CSO, the Committee are of the opinion that there is nothing to warrant a preference of one type of roller bearing over the other make so far as this refers to Timken and SKF. However, it is recommended that the CSO should continue to gather information on both these bearings. The Hoffmann bearings are so few in number that there is not sufficient data available to judge these, and CSO should gather information on these bearings also.

Railway Board's Orders.

Para 28. Trial TLL 3.4 may be continued for some time more. These records should be reviewed by the LSC periodically.

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### Item No. 27.

Subject	***	L/RG
Description	***	Regulator, etc.
LSC References	***	XXIII-15, XXV-20, XXXV-53.
CSO File Ree	***	SL/WG/IM/SH
		MD/L/RG of 31-3-55 (24) ER
		SL/WG/IM/SH of 28-6-55 (27) CSO
		M540/4/26 of 14-7-55 (29) WR
Class of loco Conce	erned	All
Trial No. (If any)	***	•••
Agenda	***	TO REVIEW ALTERNATIVE DESIGNS OF REGULATOR LOCKING DEVICES ON LOCOMOTIVES AND TO DECIDE ON THE FUTURE STANDARD.

# Notes by Secretary.

This subject was discussed at the XXXV LSC Meeting and Railway Board's orders thereon required that comments of Railways should be invited on the locking device fitted on HPS locos and also that trials should be conducted by the Central and Western Railways on WP/WG locomotives with the locking device modified in accordance with † CSL Drawing 1349.

The Chief Mechanical Engineer, Eastern Railway, has commented unfavourably on the device fitted to HPS locos and the Chief Mechanical Engineer, Western Railway, has also reported hat the device shown in CSL Drawing 1349 was tried out on 3 XC locos and found unsatisfactory since regulator creep was not prevented unless the wing nut was tightened to an undesirable extent. He has recommended the alternative design shown in his \* Drawing LCB 1843, which has been adopted after satisfactory trials on the XC locos on his Railway.

# ·Committee's Recommendation,

Para 29 (a) The Committee recommend that in view of the adverse reports on the HPS design of regulator locking device, further trials with this design are not necessary.

(b) Since the locking device shown in \*Western Railway Drawing LCB 1843 is reported to have given satisfactory service on XC locomotives over a number of years and on one WP locomotive, on the Western Railway, the Committee recommend that trials should be carried out on all Railways with this design on Broad and Metre Gauge locomotives.

# Railway Board's Orders.

Paras 29 (a & b). No further trials need be carried out with the HPS design of regulator locking device. Trials should be carried out on six Broad and 6 Metre gauge locomotives on each Railway with the device shown on Western Railway drawing No. LCB 1843. C O to issue necessary drawings and trial forms. Pending conclusion of trials this design may be followed on new builds.

# †Printed in XXIII L S.C. Report.

\* Not printed in this report

### Item No. 28

\*Subject ... L/SN

Description ... Spring and Spring Gears-Compensating Beam.

LSC References ... ... .

CSO File Ref. ... SL/WG/IM/LBS.

ML/7/03 of 1-2-55 (23) CLW

SL/WG'IM/LBS of 4-8-55 (36) CSO

\*Class of Loco Concerned ... WG

Trial No. (If any) ... ... ...

Agenda ... TO CONSIDER THE MODIFIED DESIGN OF COMPEN-

SATING BEAMS FOR WG LOCOS AS SHOWN IN CSL

DRGS, 2447 & 2020 ALT, 1.

# Notes by Secretary.

CSL Drawing 2447 shows a revised design of coupled wheel compensating beam of WG locos, providing for increased depth of section to compensate for reduction in the width experienced at CLW, consequent to the grinding down of  $3\frac{1}{2}$ " thick rolled slabs used for the beams. CSL Drawing 2020 shows a revised design of the front truck transverse compensating beam to permit a lower stress under service conditions.

# Committee's Recommendation.

Para 30. The Committee recommend that the design of compensating beams for WG locomotives shown in CSL Drawings 2447 and 2020 Alt. 1, should be adopted for new builds.

Railway Board's Orders.

Para 30. Approved.



### Item No. 29.

Subject	***	***	L/SN		
Description	***	***	Spring & Spring Gears (Compensating	g Beams)	
LSC References	•••	***	XXXII-87		
CSO File Ref.	•••	•••	SL/WG/FT MD/L/SN/Trial of 27.9.54	(136)	ER
			M 265 S. 80 of 28-10-54	(143)	CR
			MD/L/SN/Trial of 1-3-55	(180)	ER
			MD/L/SN/Trial of 9-6-55	(196)	ER
C) of Torra Com	aarned	,	WG	,	

Class of Loco Concerned.

Trial No. (If any)

... TLN 2.4 & TLN 2.5

Agenda

... TO REVIEW THE RESULTS OF TRIALS WITH ALTER-NATIVE DESIGNS OF FULCRUM POINT SUSPENSION FOR THE COMPENSATING BEAM BETWEEN FRONT TRUCK AND LEADING COUPLED WHEELS OF WG CLASS LOCOS, AS SHOWN IN CSL DRG. No. 2054 SHEETS 1 & 2.

Notes by Secretary.

Reports from the Eastern and Central Railways indicate that the arrangement of fulcrum point suspension shown in CSL Drawing 2054 Sheet 1, is superior to the alternative arrangement shown in Sheet 2.

### Committee's Recomendation.

Para 31. The Committee recommend that the design of fulcrum point suspension, shown in \*CSL Drawing 2054 Sheet 1, should be adopted as standard on WG locomotives.

Railway Board's Order.

Para 31. Approved. Railways may carry out the modification on WG locos fitted with original design of fulcrum bracket wherever rubbing of spring links with the bar frame is experienced.

\* Not printed in this report CSL Drg. No. 2381 which supersedes CSL Drg No. 2054 sheet 1 is printed in this report.

### Item No. 30.

Subject ... L/SN

Description ... Spring & Spring Gear.

LSC References

CSO File ref. ... SL/WP/LBS/III

SL/WP/LBS/III of 2/8-3-51 (1) CSO MRA/4 of 6-12-55 (151) RT&RC.

Class of loco. Concerned. ... W/Pp

Trial No. (If any) ...

Agenda ... TO REVIEW THE OSCILLATION TRIAL REPORT ON WP

LOCOMOTIVE FITTED WITH BELLEVILLE WASHER AUXILIARY SPRINGS AND OTHER MODIFICATIONS CARRIED OUT IN ACCORDANCE WITH THE FRENCH

EXPERT COMMITTEE'S RECOMMENDATIONS.

Notes by Secretary.

In terms of paras 2(9) and 2(13) of the Special Report of the Track and Loco Standards Committee Meeting held in July 1951, comparative trials have been carried out on a WP locomotive as built and as altered with one or more combinations of the following modification.

- (1) Belleville washer on hind truck.
- (2) Belleville washer auxil'ary springs on the coupled wheels.
- (3) Softer laminated bearing spring on bogie.
- (4) Belleville washer auxiliary springs on the bogie.
- (5) Roller type pintles on the compensating beams between the coupled wheels.
- (6) Reduced load on the inter drawgear.
- (7) Reciprocating balance values of 39% and 20%.

The recommendations in para 8 (Conclusions) of Oscillograph Car Report No. 9(1955) show that the best riding of the locomotive is obtained with modifications in accordance with Series I(f), viz. Belleville washers on coupled wheel hangers and compensating beam pintles modified; and that modifications to the bogie spring rigging do not improve the riding of the locomotive. It is also established that the R.O. balance and inter-buffer load for the best riding of the locomotive appear to be 39% and 22000 lbs. respectively.

In line with these recommendations, the Committee may consider the adoption of Belleville washer auxiliary springs on coupled wheel hangers, and modified compensating beam pintles as shown in CSL Drawing 1989 and CSO Sketch L—90 respectively. The R. O. balance and inter-buffer load do not require any change as the figures quoted are existing values.

The Committee's attention is, however, drawn to the fact that a number of cases have been reported on YP locomotives of Belleville washers breaking in service and the matter is at present under reference with the makers.

# Committee's Recommendation.

Para 32. The Committee accept the recommendations contained in the Oscillograph Car Report No. 9 on WP locos and recommend that the modifications may be incorporated on both new builds and existing locos subject to a satisfactory design of auxiliary spring being evolved, since the Belleville washers on YP locomotives have failed in service.

Railway Board's Orders.

Para 32. Noted. CSO should, in consultation with manufacturers, evolve a more satisfactory design of auxiliary spring.

# Item No. 31.

Subject ... L/SX

Description ... Smokebox, Superheater Headers Etc.

LSC References ... ... XXXII-16, XXXV-65.

CSO File Ref. ... SL/SH

SL/SH/ of 6-4-1955 (579) CSO

SL/SH of 30-9-1955 (600) CSO

Class of Loco concerned ... WM & XT.

Trial No. (If any) ... ... TLC 4.1 and 4.2

Agenda ... TO CONSIDER RESULTS WITH THE DESIGN OF A

MULTIPLE VALVE HEADER HAVING VALVES ON THE SATURATED SIDE WITH AND WITHOUT ANTI-VACUUM VALVES, WITH A VIEW TO DETERMINING WHETHER THEIR USE IS ACCOMPANIED BY INCREASE IN ELEMENT LIFE, AS COMPARED WITH THE CONVENTIONAL HEADER HAVING VALVES ON THE SUPERHEAT SIDE.

Notes by Secretary.

Reports from Northern and Eastern Railways, if received, may be considered by the Committee.

# Committee's Rocommendation.

Para 3. In view of the report submitted by the Eastern Railway which indicates that there is little difference between the two type of headers, the Committee recommend that the trials be closed.

# Railway Board's Orders.

Para 33. The MVR Header with valves on the superheat side should be used on renewal boilers fitted with this type of header. The present standard of dome type regulator to continue.

# Item No. 32.

Subject ... ... L/TE L/BG

Description ... Tender Bogie

Brake Gear details.

LSC References ... ...

CSO File Ref. ... SL/TCA/WG

IRS/H of 11-7-55 15-7-55 (191) C. I. Japan (192) "

SL/X-9/WG of 21-7-55

(193) CSO.

Class of Loco concerned ... WP/WG

Trial No. (If any) ... -

Agenda ... ... TO CONSIDER THE MODIFICATIONS TO WP/WG BRAKE GEAR

ARRANGEMENT TO PROVIDE ADDITIONAL PULL ROD ADJUSTMENT FACILITIES AS SHOWN IN CSO SKETCHES L-343, L-368

AND L-382.

Notes by Secretary.

CSO Sketch L-382 shows the revised design of brake pull rods with three pin holes to facilitate adjustment in service. CSO Sketches L-343 and L-368 show the revised arrangement of brake rigging and the modification to bogic transom in order to allow extra clearance between the pull rod and the transom.

# Committee's Recommendation.

Para 34(i) The Committee recommend that the modifications to the brake gear of WP/WG tenders, shown in CSO Sketches L-343 and 368 should be adopted on existing and future locomotives.

(ii) The Committee also recommend that the CSO should investigate the possibility of obtaining a larger range of adjustment than what is possible with the design shown in CSO Sketch L-382.

Railway Board's Orders.

Para 34 (i) Approved.

(ii) CSO to investigate and issue drawings.

## Item No. 33.

... L/TE Subject Tender Bogie Description XXXIII-50 LSC References SL/WP/BT CSO File Ref. M. 104 RL. 9 of 14-5-54 (34)CR: SL/WP/BT of 16-7-55 (54)C\$O~ Class of Loco Concerned ... WP/WG. Trial No. (If any) ... TO CONSIDER THE MODIFIED DESIGN OF BEARING Agenda SPRING SAFETY STRAP FOR WP/WG CAST STEEL AND PRESSED STEEL TENDER BOGIES, AS SHOWN IN

Notes by Secretary.

The I.R.S. type of safety straps was accepted as standard for WP/WG tender bogies vide Para 50 of the minutes of the XXXIII LSC Meeting. CSO Sk. L-358 shows this type of safety strap for cast steel and pressed steel tender bogies of WP/WG locomotives.

SKETCH NO. L-358.

# Committee's Recommendation.

Para 35. The Committee recommend that the modified design of bearing spring safety strap for WP/WG tender bogies, shown in CSO Sketch L-358, should be adopted for future builds.

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Railway Board's Orders.

Para 35 Approved.

#### Item No. 34.

Subject ... ... L/TY.

Description ... Tyres.

LSC References ... ... -

CSO File Ref. ... SL/WP/TYR

CDE (L)'s noting dated 18-10-55 on page 75/n.

Class of Loco concerned  $\dots$  WP, WP/p

Trial No. (If any) ... -

Agenda ... TO CONSIDER THE PROVISION OF RIVET FASTENED TYRES ON WP, WP/p LOCOMOTIVES, AS SHOWN IN

CSL DRAWINGS 2479 and 2480.

Notes by Secretary.

A number of cases have been reported of the coupled wheel tyre shifting on the wheel rim of earlier WP and WP/p locomotive which did not have any positive fastening.

CSL Drawings 2479 and 2480 show the method of side rivet fastening of these tyres on existing wheel centres. The Committee may consider the adoption of this proposal as and when replacement of old tyre is necessary.

### Committee's Recommendation.

Para 36. The Committee recommend the adoption of the method of rivet fastening of tyres on the coupled wheel centres of existing WP/WP/p locomotives, shown in CSL Drawings 2479 and 2480.

Railway Board's Orders.

Para 36. Approved for new builds. Railways may carry out the modifications as and when necessary.

Item No. 35.

Subject ... L/WL

Description ... Wheel & Axle.

LSC Relerences ... -

CSL File Ref. ... SL/LB

SL/LB of 5-5-55. (515) CSO

and replies thereto.

Class of Loco concerned ... ALL IRS

Trial No. (If any) ... -

Agenda ... TO CONSIDER TRIALS WITH THE "NALCO" WHEEL FLANGE LUBRICATION ARRANGEMENT ON BROAD,

METRE & NARROW GAUGE LOCOMOTIVES.

Notes by Secretary.

The provision of wheel flange oil lubricators on locos has been disfavoured by Railways owing to maintenance difficulties and the possibility of foreign matter contaminating the oil. Messrs. National Aluminium Corporation, Chicago, have now developed the 'NALCO' wheel flange lubricator using Molybdenum Di-Sulphide sticks for lubrication, and claim that this arrangement is free from the difficulties experienced with the oil lubricators. The Committee may approve trials being conducted with the NALCO lubricator on Broad, Metre and Narrow Gauge locomotives.

### Committee's Recommendation.

Para 37. The Committee recommend that trials with the "NALCO" wheel flange-lubricator be carried out on the Central, South-Eastern, Northern and North-Eastern Railways.

Railway Board's Oorders.

Para 37. Approved. CSO to issue necessary trial forms.

#### Item No. 36.

Subject ... L/WL Description Wheels & Axles LCS References XXXIII-39 SL/WA CSO File Ref.

SL/WA of 15-10-51

(111)CSO

and replies thereto

(272)**CSO** 

SL/WA of 4-7-55 and replies thereto

Class of Loco Concerned

I.R.S. Locos

Trial No. (If any) ...

Agenga

TO STANDARDIZE THE MATERIAL & METHOD OF LUBRICATION OF WHEELHUB LINERS ON COUPLED WHEELS OF I.R.S. LOCOMOTIVES.

Notes by Secretary.

Cast iron hub liners were accepted as standard, vide Para 38 of the Minutes of the XXXIII LCS Meeting, owing to difficulty in obtaining and machining manganese steel liners in India. On the basis of subsequent experience with imported locos, preference is now expressed in favour of manganese steel liners. The Committee may decide:—

- Whether manganes steel hub liners should be adopted as standard and cast iron liners as Permissible Alternative;
- (b) the method of securing the manganese steel liners to wheel hubs.
- the method of lubrication-whether through the wheel hub or through the axle-(c)
- (d) the type of lubrication—Soft grease or oil.

### Committee's Recommendation.

#### Para 38. The Committee recommend that-

- 11 to 14% manganese steel liners in halves, secured to the wheel hub by set secrews, should be adopted as standard.
- cast iron liners in halves should be accepted as a Permissible Alterna-(ii) tive for indegeneous manufacture.
- The lubrication should be by soft grease charged through two grease nipples in the wheel hub, general as shown in \*Western Railway Drawing LM 298, (iii) and auxiliary lubrication by hard grease should be providedt hrough lead in grooves on the axlebox crown bearing, as shown in IR Part Drgs. L/AB-634 and 635.

### Railway Board's Orders.

Para 38. (i) Approved.

- (ii) Approved.
- (iii) Approved.

<sup>\*</sup>Not printed in this Report.

#### Item No. 37

Subject

... L/WL.

Description

... Wheels & Axles—Crank Pin.

LSC References

...

CSO File Ref.

... SL/WP/WA/1

SL/WP/WA/1 of 4-11-55

(3) CSO

SL/WP/WA.

Noting dated 1-6-55 and 27-9-55 on pp. 44/n & 50/n.

Class of Loco Concerned.

WP, WP/p

Trial No. (If any)

Agenda

... TO CONSIDER THE REVISED DESIGNS OF LEADING AND TRAILING CRANK PINS ON WP/WG LOCOMOTIVES SHOWN IN IR PART \* DRAWINGS L/WL-634, 635 AND CSO SKETCH L - 360.

Notes by Secretary.

Out of 23 failures so far reported, 16 have occurred on the Eastern and South-Eastern Railways, and the fractures have taken place at the junction of the crank pin with the wheel boss. The fillet radii were found to be inadequate and were attributed to be the main cause of crank pin failures.

With the present design of coupling rods and dimensions of the crank boss on the wheel centres, it is not practicable to increase the diameter of the crank pins by more than  $\frac{1}{4}$ ", on existing WP locomotives.

For new WP locomotives, the leading and trailing crank pin diameter has been increased from 4" to 5". This will necessitate the redesigning of coupling rods and increase in the diameter of the crank boss.

On existing WP locomotives, it is desirable to reverse the coupling rod floating bushes so that the collar of the bush is towards the crank boss as detailed in the arrangement shown in \*CSO Sketch L-385, in order to eliminate reduction in the fillet radius, consequent to rubbing contact with the floating bush in service.

The Committee may consider adopting the following measures:-

(a) For existing locos. - Whenever renewals are necessary.

Crank Pins, to IR Part Drgs. L/WL-633 634 & 635,

Floating bushes to IR Part,, L/CR-686, 632 Alt. 1,685.

Fixed bushes, to IR Part , L/CR-660, 630, 629 Alt. 1.

Leading Coupling Rods,

to IR Part ,.

L/CR-658 and 659.

### (b) For New Locos.

Increase the crank pin diameters from 4" to 5".

- (c) The Committee may also consider the use of nickel chrome steels for locomotive crank pins recommended by the Chief Mechanical Engineer, Eastern Railway, the most suitable alloy being 2½% nickel-chrome-molybdenum steel to BS. 970 En. 25.
- (d) The Committee may also decide on the steps to be taken by Railways in the interim period prior to renewal of crank pins, in order to eliminate fracture of crank pins in service.

### Committee's Recommendation.

Para 39. Committee recommend that :-

- (a) For new builds of WP class locomotives, the diameter of leading and trailing crank pins should be increased from 4" to 5".
- (b) For existing locos, the diameter of the wheel seat on the crank pin should be increased to provide a larger fillet radius joining with the existing diameter of crank pin journal.
- \* Not printed in this Report.

- (c) The floating bush should not be reversed. The end-of the bush should, however, be backed off to avoid contacting the fillet radius.
- (d) In those cases, where the lubrication is through the pin, the lubricating hole in the pin should extend diametrically across.
- (e) Railways experiencing failures with these pins should take suitable action to ensure that the fillet radius is maintained.
- (f) The lubricating holes on the inner surface of the floating bushes should be countersank.

### Railway Board's Orders.

### Para 39. (a) Approved.

- (b) CSO to issue Part Drawings corrected to show increased diameter at wheel seat and journal for leading and trailing crank pins suitable for use with existing coupling rods and fixed bushes. Increased fillet radius on all the crank pins should be provided.
- (c) Approved. CSO to issue drawings.
- (d) On leading and trailing crank pins where lubrication is through the crankpin the lubricating holes should be located diametrically opposite from the central hole but spaced 1/2" apart.
- (e) Approved.
- (f) Approved. CSO should incorporate this feature on part drawings.



Item No. 38.

Subject L/WL. L/AB, L/FR.

Description \_\_ Wheels & Axles.

LSC References \_\_\_ XXXV-76

CSO File Ref. ... SL/WP/WA S. No. 54/731/11/M dt. 11.3.55 (RB)

Class of Loco Concerned ... WP

Trial No. (If any) ... --

Agenda ... TO REVIEW THE FAILURES OF COUPLED AXLES ON WP LOCOS AND CONSIDER INCREASING THE JOURNAL DIAMETERS OF THE LEADING AND TRAILING

COUPLED AXLES.

Notes by Secretary.

The failures of WP coupled axles were reviewed at the XXXV LSC Meeting. Since then, there have been further reports by the Railways involving a total number of 12 leading and 8 trailing axles.

The Railway Board, in their orders on para 76 of the Minutes of the XXXV LSC Meeting, desired that trials should be carried out on the Central Railway with oil-lubricated axleboxes, (for which drawings have since been issued by the C.S.O) and that the Research Directorate should carry out temperature trails to determine the operating temperature of leading and trailing coupled axle bearings. The trial reports from the Central Railway and Director Research are still awaited.

For the new builds of WP locomotives, the specification calls for increase of journal diameters of the leading and trailing coupled axles from 8" to 8½". The bar frames will be redesigned to suit the increased journal diameters.

Regarding existing WP locos, the following CSL Drawings have been prepared showing modifications which are to be carried out for using axles having 8.3/8" dia. journal, in replacement of existing axles having 8" dia. journal:

CSL 2284 ... L & T coupled axles (8.3/8" journal).

" 2285 ... L & T axlebox to suit " "

" 2286 Pedestal shoes and wedges for leading and trailing coupled horns to 8.3/8" journal.

# " 2289 ... Modification to L & T coupled wheel centres to suit 8.3/8" journal.

No modifications are necessary to the existing bar frames.

The Committee may recommend the replacement of the existing axles on the leading and trailing coupled wheels with axles having enlarged diameter as and when renewals are necessary and also the approval of the modified designs shown in CSL drawings referred to above.

### Committee's Recommendation.

Para 40. In view of the large number of failures experienced on WP class locomotive coupled axles, and continuance of failures, the Committee does not consider that the increase in diameter of the leading and trailing axles to  $8\frac{1}{2}$ " on new builds would fully meet the situation, particularly in view of the trials recently carried out by the Research Directorate which were discussed at the Meeting. The Committee, therefore, strongly recommends the adoption of roller bearing coupled axleboxes on new builds since this is the only means of eliminating the possibility of copper penetration. This is all the more necessary in view of the likely introduction of high speed trains hauled by WP locomotives.

Para 41. For existing locomotives, the Committee recommends that the diameter of the leading and trailing coupled axles be increased to 8.3/8" as and when existing axles need to be replaced and the modifications shown in CSL Drawings 2284, 2285, 2286, and 2289 be followed in this connection.

### Railway Board's Orders:

Para 40. Roller bearing axleboxes should be fitted on the coupled axles of future builds of WP locomotives.

Para 41. Approved.

\*CSL 2512 Supersedes CSL Drg No. 2289 and is printed in this report.

#### Item No. 39.

Subject

... L/Design

Description

Design.

LSC References

XXXV-78

CSO File Ref.

SL/WH

S. No. CSO (1 & 2)

SL/WH of 25-6-55 & 27-6-55

and replies thereto.

Class of Loco Concerned

WH

Trial No. (If any)

Agenda

TO RECORD PARTICULAR SPECIFICATION NO. L-7 OF 1955 AND CSL DRG 2441 ALT 1 SHOWING THE TENTATIVE DIAGRAM NOR WH CLASS 2-8-4 TANK BG LOCOMOTIVE FOR SHUNTING SERVICE.

Notes by Secretary.

In pursuance of the Railway Board's Orders on para 78 of the minutes of the XXXV LSC Meeting, the diagram and draft specification for the WH class BG shunting locomotive were circulated to Railways and their comments obtained. Particular Specification No. L-7 of 1955 (Appendix III) and CSL Drg. No. 2441 Alt. 1, showing the diagram and brief particulars of the WH locomotive have since been prepared for approval.

### Committee's Recommendation.

Para 42. The Committee record Particular Specification No. 7 of 1955 and CSL drawing No. 2441. Alt. 1 for WH class locomotive but suggests that the feasibility of providing a power reversing arrangement may be investigated.

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Railway Board's Orders.

Para 42. Noted. CSO should investigate the possibility of installing a power reverse gear.

#### Item No. 40.

... L/Designs. Subject Designs. Description XXXII-104 & 112 LSC References S. No. SL/MISC/XII CSO File Ref. Letter No. SL/Misc/ XII of 25-10-51 (CSO) (25)and replies thereto. SL/X-11. M.584. RC. 59. RL of 11-5-55 (CR)(39)SL/X-11 of 15-7-55 (ČSO) (80)102) M 224 RL 88 of 22-7-55

\*Class of Loco Concerned

N.G.

Trial No. (If any)

Agenda

TO CONSIDER THE DESIGN OF 2-8-2 TYPE LOCO-MOTIVE SHOWN IN \*CSL DRAWING 2445 ALT. 1 AND DECIDE WHETHER IT SHOULD BE ACCEPTED AS A STANDARD LOCOMOTIVE FOR 2'-6" GAUGE.

Notes by Secretary.

The rationalisation of N. G. locomptive was discussed at the XXXII LSC Meeting and in terms of the Committee's recommendations, the following classes have been accepted as standards subject to satisfactory trials of prototypes :-

- (1) ZP 4-6-2 Passenger Locomotive with an axleload 7 tons;
- (2) N 4 AD/Z 4 AD-Mixed Service Diesel locomotive for 2'-0"/2'-6" gauge sections capable of taking  $7\frac{1}{2}$  ton axleload.

These are in addition to the existing type of steam locomotives which are -

2-6-2 passenger locomotive with maximum axleload

2-8-2 goods locomotive with maximum axleload 8 tons. ZE

2-6-2 Tank locomotive with maximum axleload 9.5 tons. ZF for Kalka-Simla Section.

The ZB and ZE locos are being ordered on Rolling Stock Programmes.

Not finding any of the above types of steam locomotives suitable for the operating conditions on the Yeotmal-Murtizapur-Elichpur section, the Central Railway have expressed the need for a 2-3-2 type steam locomotive having a maximum axle load of 7 Tons.

The principal features of the new 2-8-2 steam locomotive, as shown in CSL Drg. 2445 Alt. 1 and detailed in Particular Specification L-10 of 1955, are-

> Boiler identical with YL & ZP

Tender interchangeable with ZP

Maximum axleload 7 tons.

Nominal tractive effort at 85% Boiler Pressure ... 18,250 lbs.

The locomotive has been designed to haul loads up to 400 tons at a maximum speed of 10 miles per hour on ruling gradients of 1 in 100 Up.

The Committee may consider whether there is a general need for this class of locomotive on 2'-6" gauge section of railways, and express their views on the suitability of the design shown in CSL Drawing 2445 Alt. 1 and detailed in Particular Specification L-10 of 1955. (Appendix IV).

### Committee's Recommendation.

Para 43. In view of the uncertainty of the future of N.G. Railways, it is not considered worthwhile to make additions to the existing standard types of N. G. Locos. Individual requirements of Railways, outside the existing standard types, should be treated as special cases.

Railway Board's Orders.

Para 43. For the present, no addition should be made to the existing standard types of N.G. locos.

\* Not printed in this report.

#### Item No. 41.

Subject ... L/Misc.

Description ... Miscellaneous.

LSC References

CSO File Ref. ... LSC XXXIII

Railway Board's letter No. 52/731/I/M

dated 30-7-52 to all G.M.S.

(17)

Class of loco Concerned

37 70

Trial No. (If any)

Agenda

... TO BLECT THE MEMBERS OF THE SUB-COMMITTEE OF THE XXXVII LOCO STANDARDS COMMITTEE.

Notes by Secretary.

Members are requested to elect two members for the Sub-Committee of the XXXVII LSC to be held in 1956.

#### Committee's Recommendation.

Para 44. The Committee recommend that the Chief Mechanical Engineers of Western and Central Railways should be the members of the XXXVII LSC Sub-Committee.

Railway Board's Orders.

Para 44. Approved.

Item No. 42.

Subject ... L/M

Description ...

LSC References

C.S.O. File Ref. ..

Class of Loco concerned .

Trial No.

Agenda ... TO DISCUSS DELAYS IN COMPLETION OF TRIAL

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REPORTS.

Notes by Secretary.

This subject was brought up for discussion at the meeting on the request of the representative of the Director Research/Lucknow. The Committee may express its views on it.

### Committee's Recommendation.

Para 45. The Committee feels that it will be of considerable assistance to it if subjects referred to the Research Directorate are dealt with expeditiously. It is understood that the delay in submission of trial reports is due to insufficient facilities with the Research Directorate to carry out their investigations.

Para 46. To this end the Committee recommends that the adequacy of the strength of the Mechanical Branch of the Research Directorate should be investigated and increased if necessary by the formation of a maintenance unit. When this is done the Research Branch should then be more closely associated with investigations sponsored by the LSC,

Railway Board's Orders.

Para 45.
Para 46.
Research Directorate to take action.

### Appendix I to Item No. 5.

Note by Director Research on Standardisation of friction fabric material for front and hind truck liners on locomotives.

- 1. The Loco Standards Committee considered at its 30th meeting held in February 1950 the question of excluding from the permissible alternatives such brands of friction fabric material as had proved unsatisfactory in actual service. This question could not be decided as performance data on the different brands of fabric liners was not available.
- 2. In January 1951, the Research Wing of the Central Standards Office developed a method of determining the coefficient of friction of the fabric liner mating with the metal liner, fitted in position on the front truck (bogie or pony) of the locomotive. This method consisted in the control springs of the front truck being put out of action by comressing them solid, and in placing the front truck on the turn-table with the rest of the locomotive lying on the approach track. The load on the turn-table was then balanced by placing a loaded wagon at the opposite end to ensure low and consistent resistance of the turn-table to its movement from rest. The force required to move the turn-table was that necessary to overcome the friction between the metal and the fabric liners and the resistance offered by the turn-table itself. Thus with the turn-table celibrated for its resistance to motion from rest, the force due to friction of the liners could be easily determined. The arrangement adopted for the above test is given in Fig. 1.
- 3. Seven series of tests have been carried out on the three brands of fabric liners, fitted to the WP and WG Locomotives, in the course of the last 4 years. The results of these test are given in Table I. The following conclusions are drawn from these results.
  - (i) Under normal service conditions, none of three brands, namely Don Salvabestons, Mintex R-1 and Mintex /98 possess the property of maintaining the coefficient of friction constant at a value of 0.16 or below it.
  - (ii) In actual service, the value of the coefficient of friction has ranged from 0.15 to 0.32 irrespective of the mileage completed by the locomotive in service. This erratic behaviour is attributable to contamination to the bearing surfaces of the liners by oily dirt or grit and to the formation of rust on the metal liners. Corrosion and contamination have been noticed on both steel and bronze liners.
  - (iii) Tests on experimental graphited liner mating with fabric liner have shown that with the graphite coating getting disturbed, the coefficient of friction, initially of a low value of 0.16, increases to a value of 0.25 to 0.29. The application of graphite coating on the metal liner shows promise, but a suitable method of getting a tough coating has still to be developed.
- 4. The C.S.O. circular letter No. SL/OSL/1 dated 25.3.55 addressed to Railways indicates that fabric material of the Railko Al. 2 brand manufactured by Messrs. Small and Parkes Ltd., Manchester has been accepted as standard for fabric liners of Indian Locomotives. This decision appears to have been based on the so called satisfactory service given by the Railko Al. 2 (originally known as Don Salvabestos) liners, inspite of the fact that on actual tests the coefficient of friction given by the Railko Al. 2 has been as high as 0.2 to 0.3. The fact that there have been no serious operating defects with locomotives using Railko Al. 2 liners does not necessarily indicate that some of the troubles peculiar to the WP locomotives are not attributable to the high coefficient of friction produced by this brand, or for that matter other brands of liners.
- 5. The lateral spring control on the front and the hind trucks becomes 'ineffective' with this high coefficient of friction, with the result that distortions in the track and heavy stresses in the engine frame or the running gear can occur, when going over curves. Trials carried out on turnouts have given widely varying flange forces on the leading and trailing coupled wheels of the WP (10-14.5 tons on leading coupled and 4 to 14 tons on trailing coupled) and from this it would be clear that the lateral spring control has not functioned satisfactorily due to high coefficient of friction of the liners. The bar frame is laterally stiffer than the plate frame and it may be that the high flange forces developed on the WP on turnouts have caused heavy stresses on the coupled axle assemblies. One of the causes of the WP axle failures may therefore be traced to defective function (Partial seizure) of the friction damping on the bogie and the hind truck.
- 6. From the general analysis presented above it can be clearly seen, that so for as the existing brands of friction liners are concerned, their performances are identical and as long as friction damping consisting of fabric and metal liners continues to be used, all the brands can be accepted as permissible alternatives, but none can be adopted as a standard at this stage.
- 7. While manufacturers of the friction fabric material may investigate into possibilities of developing a suitable material, which without any external lubrication can produce a coefficient of friction below 0.16 and maintain it constant in service, experiments with dry and semi-dry lubrication of the existing fabric liners mating with metal liners are to be carried

out to definitely indicate whether friction damping of this type can at all be accepted in Indian practice. These experiments relate to the

- (a) development of a suitable graphite coating which will withstand the working conditions on the locomotives for dry lubrication of the friction damping system,
- (b) successful application of graphited grease or some other form of semi-dry lubricant, both of metal to metal and metal to fabric liner combinations, and
- (c) development of a suitable metal liner and its surface finish for bearing contact with fabric liner to obtain a low coefficient of friction below 0.16, which can be maintained constant in service without external lubrication. (This investigation is being carried out by the National Metallurgical Laboratory for the Railway Testing & Research Centre).
- 8. In the light of the facts stated above, the Committee may take a decision that all the existing brands of fabric liners should continue as permissible alternatives until the experiments with dry and semi-dry lubrication are completed, or the manufacturers are able to offer friction fabric material of suitable quality.



REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE.

TABLE I to APPENDIX I Summary of Regults of Friction Liner Trials.

<del></del>	Total No. of tests conducted in each series	Class of locomotive and details of Friction Liners.	Mileage in thousands	Coefficient of friction minimum and maximum values recorded	Remarks
	<b>9</b>	WG steel matting with Don Salvabestos liners.	20 to 30 30 to 40 40 to 50 50 to 60 60 to 70	0·15 to 0·25 0·19 to 0·29 0·21 to 0·28 0·17 to 0·25 0 21 to 0·32	Lower values of coefficient of friction were recorded when the liner surfaces had some oil and grease on them. Higher values were however recorded when the oil or the grease was wiped off from the bearing surfaces, and also in cases where dirt and grit had found their way-in-between the bearing surfaces.
	32	WG steel mating with Mintex R-I liners.	20 to 30 30 to 40 40 to 50 50 to 60 60 to 70	0.18 to 0.24 0.18 to 0.30 0.18 to 0.27 0.20 to 0.22 0.18 to 0.21	-Do-
	ĸ	WP bronze mating with Don Salvabestos liners	60 to 66	0.25 to seizure (Some locomotive bogie slides were found seized).	Seizure of bogic slides was traced generally to rust formation on metal liner.
	16	WP bronze mating with Don Salvabestos liners	(500 miles) 20 to 30 40 to 50 60 to 70 80 to 100	0.16 to seizure (-do-) 0.19 to " (-do-) 0.29 to " (-do-) 0.33 to " (-do-) 0.27 to " (-do-)	
	63 4	WP bronze mating with Mintex R-I liners WP bronze mating with Mintex	(New liners) 60 to 70	0.21 to ', (-do-) 0.22 to 0.32	
	<b>L</b>	WP graphited bronze mating with Don Salvabestos liners.	(New liners) (950 miles) 12 to 30	0.16 0.22 to 0.3 0.26 to 0.3	Graphite coating was found to have flaked off when examined after 12 to 13 thousand miles run in service.

### Appendix II to Item No. 7.

Minutes of the Boiler Inspector's Meeting held in the Central Standards Office, Chittaranjan on 20th & 21st December 1955.

Ref :- C.S.O., Chittaranjan's letter No. SL/WP/BRM dated 8-12-55.

The following were present:-

Shri R.K. Sethi, A.C.D.E(L), CSO, Chittaranjan..

- " Ramdhan, A.W.M., C.L.W., Chittaranjan.
- " K.S. Krishnan, S.O. (B), CSO, Chittaranjan.
- ,, Saligram, IOR (T), Tatanagar.
- " M. N. Pandey, B.I.O., DHN, ERly.
- " J. E. Carr, Chief B.I.O., SRly.
- ,, H.W. Tychicus, B.I.O., KGP, SERly.
- " E.A. Robeiro, Boiler Foreman, Dibrugarh, NERly.
- ,, A.C. Bates, Boiler Inspector, Jubbulpore, CRly.

The meeting was called by the Chief Design Engineer (Loco), to review the existing washout & inspection facilities on IRS locomotive boilers, in the light of experience gained by running sheds.

The proposals made by the representatives of the various railways are detailed in the following paragraphs.

### 1. Smokebox Tubeplate.

All the railways were unanimously of the opinion that 2 or three washout plugs should be provided between the flues and smoke tubes and that a corresponding number of two topmost plugs on the sides, as now provided, can be eliminated.

### 2. First Barrel Course.

The general concensus of opinion of the railways was that a cooling plug on the top of centre line of the boiler ahead of injector clack box, is necessary for the following reasons:

- (1) Admission of cold water at the coldest part of the boiler.
- (2) Facility to fill the boiler up completely for testing the elements & joints.

The Central, North-Eastern and Eastern Railways were, however, of the opinion that if this cooling plug is provided, there is no necessity to retain the existing mud door on the top left hand side of the first barrel course, as at present provided. The Southern & Southern Rlys. felt that not only should the mud door be retained, but it should be enlarged to the size of an inspection door.

### Intermediate Barrel Course.

No change was considered necessary.

### Hind Barrel course.

One mud door and one inspection door, as at present provided on the left and right hand sides above the crown level, should be retained. The railways, however, felt that the inspection door should always be located above the level of the top row of flues.

The two mud doors provided along the bottom sides of the barrel on WP,WG,WL,YP- & YG boilers, should be retained. For Tank locomotives and smaller boilers, the two bottom mud doors are not necessary.

### 3. Outer Firebox Throat Plate.

All the railway representatives were of the opinion that, in the case of WG, WP, WL, YP, YG, YL, and ZP locomotives, two mud doors (one left and one right hand) along the corner radius, as high up as possible, should be provided. In the case of Tank and ZE locomotives, this provision was not considered necessary.

### 4. Outer Firebox Wrapper Plate.

The railway representatives were all agreed that, to ensure proper washing out of the thermic syphon, three washout plugs of as large a size as practicable, should be provided on

the outer firebox casing vertically above the thermic syphon. They felt that mud or inspection doors should not be provided in this location as, in the event of door falling down accidently, it would be very difficult to extract it from the thermic syphon.

It was considered that in the top corner section of the firebox casting above the crown level, only inspection doors, and not mud doors, should be fitted wherever practicable. The total number of inspection doors in this location should be between 3 to 5, depending on the size and type of boiler, the doors being staggered on the right and left hand sides.

#### 5. Firebox Backplate.

All the railway representatives were agreed that the mud plugs as provided at present along the mid section of the flange radius on either side do not serve any useful purpose. This should be replaced by mud doors even though it may be necessary in cases to relocate the opening to avoid fouling other locomotive fittings.

In the case of the ZE boilers, it is desirable to provide two washout plugs at the level of the crown.

- 6. After completing discussion of the inspection and washout facilities, opportunity was taken to discuss others aspects of boiler maintenance, etc., with the railways' representatives and these are noted in the following paragraphs:
- (i) The ERly representative mentioned that difficulty was being experienced on his Rly. in readily removing the existing spark arrestor screens and fall plates during every washout and requested a reconsideration of the design so as to make it easier for removing the screens. The C.S.O. agreed to investigate the matter and let the ERly representative hear about it.
- (ii) The CRly representative mentioned the difficulty experienced in making use of the washout plugs at the rear corners of the foundation ring for washout and inspection purposes. The railway representatives were of the opinion that if the cab floor plates could be altered with suitable sizes of flaps, this would facilitate proper washout and inspection. It was agreed that the CSO would investigate this proposal.
- (iii) The railway representatives were generally agreed that the provision of gusset plates for stiffening the flat portion of the top section of the outer casing and firebox back plates on WM boilers restrict the vision. They were of the opinion that in future builds, these gusset plates should be replaced by the either longitudinal stays or diagonal braces.
- (iv) The C.S.O. asked the railway representatives to express their opinions on the proposal to replace the washout plugs provided at the four corners of the foundation rings by mud doors as a standard practice on future builds. The general consensus of opinion was that the existing arrangement of 2-way washout plugs at the front corners and single washout plugs at the rear corners was quite satisfactory and should continue.
- (v) The C.S.O. desired that the railway representatives express their opinion on whether the new type of flat faced inspection and mud doors, which had now been adopted as a standard, obstructed the line of vision to such an extent that a change in the design should be undertaken. For this purpose, the railway representatives inspected boilers in the Chittaranjan Loco. Works fitted with both the old and new designs of doors and were of the opinion that the reduction in the range of vision is so negligible that compared with the other advantages of the flat faced seating over the older design, the flat faced joint should be retained as standard. They, however, requested the Central Standards Office to investigate the possibilities of reducing the projection of the seating on the water side to the minimum extent possible.
- (vi) C.S.O. pointed out that according to the N. W. Rly. practice, no copper ferrules were fitted in steel firebox tubeplate holes for the flues and tubes, nor was any beading done. These tubes were kept with a 1/8" projection into the firebox, expanded & welded. The SERly representative pointed out that this method had been tried out on a few boilers on his railway and no difficulty had been experienced. The railway representatives, therefore, felt that if it is agreed the repair shops should be requested to turn out a few locomotives without copper ferrules and welding, without beading over of the tubes & flues, for trial purposes, and that a decision on this matter should be taken on the results of these trials.
- (vii) It was pointed out that the necessity for beading over of the flues and some of the tubes at the front end on WP/WG, YP/YG boilers should be investigated as this practice appeared to be unnecessary. The railway representatives were of the opinion that if the elimination of such beading was not detrimental to strength from a theoretical stand point, trials may be carried out on railways to determine whether such beading should be eliminated in the future.
- (viii) The Central Standards Office took the opportunity of enquiring from the railway representatives the practice followed on individual railways for washing out of boilers. Discussions revealed considerable divergence in the number of hours allowed for a hot & cold water washout as follows:

Time taken from the Commencement of blowing out of steam to completion of washout.

Railway	Cold water washout	Hot water washout.
ERly	6 to 8 hrs.	5 to 7 hrs.
CRly	19 hrs.	6 to 7 hrs
		(economical washout plants)
SRly	20 hrs. for B.G.	***
	16 hrs. for M.G.	•••
SERIy	•••	13 hrs.
NERly	en e	400

(In the case of the NERly, the representative felt that as he had been out of touch with the actual running shed work, for over a year, it was not possible for him to indicate the exact present practice.)

In view of the above divergence in the time taken for washing out a boiler on the various railways, the railway representatives felt that some action should be taken after proper investigations into the effects of the various methods adopted by different railways, to standardise the practice for all Indian railways.

- (ix) All the railway representatives agreed that in the case of the single washout plug seatings, the projection of approximately 2" from the plate reduces the range of visibility considerably and that this design should be replaced to advantage by an ordinary reinforcing patch plate.
- (x) The railway representatives agreed that the longitudinal axis of the inspection and mud doors on flat surfaces, barrels, and top section of the casing sides should be horizontal. The mud doors located on the radii of the outer throat plate and back plate should, however, have their longitudinal axes in the vertical plane.
- (xi) The railway representatives felt that there was no necessity to seal weld the bottom seams of the inner & outer firebox plates in those cases where the foundation ring had a double riveted joint. The C.S.O. was requested to investigate this matter.

The boiler inspectors took the opportunity of going round the Chittaranjan Loco. Works, at the conclusion of the meeting.

Sd/-	Sd/-	Sd/-
(R.K. Sethi)	(K.S. Krishnan)	(Saligram)
Asst. Chief Design	Sectional Officer	Inspecting Officer,
Engineer,	(B),	Rlys.,
C.S.O.	C.S.O.	Tatanagar.
Sd/-	Sd/-	Sd/-
(M.N. Pandey)	(J.E. Carr)	(H.W. Tychicus)
B.I.O./DHN	Chief B.I.O.,	B.I.O. KGP
ERly.	SRIy.	SERly.
Sd/- (E.A. Rebeiro) Boiler Foreman, Dibrugarh, NERly.	Sd/- (A.C. Bates) Boiler Inspector Jubbulpore, CRly.	Sd/- (Ramdhan) A.W.M., CLW, Chittaranjan.
Chittaranjan,		

Dt. 21st Dec. 1955.

## C.S.O's Comments on the Minutes of the Boiler Inspectors' Meeting held in C.S.O. Chittranjan, on 20th and 21st December, 1955.

### Para 1. Smokebox Tube plate.

The proposal to rearrange washout plugs is shown on C. S. O. Sketches Nos. L-393 Alt. 1, 394 Alt. 1 and 395 Alt. 1. In the case of the WL and ZE class boilers, the rearrangement can be made without having to remove any smoketubes. In the case of the other boilers, however, this can only be done by reducing the number of smoketubes by two. This will result in the following reduction in the Free Gas Area ratio for the respective boilers:

Grate Area

	Existing F.G.A.	Modified F.G.A.
	——— ratio. G.A.	G.A. ratio.
wu	14.6%	14.5%
ww	17.8%	17.6%
WM	14.0%	13.0%
WG/WP/WP/p	13.7%	13.6%
YP/YG	12.6%	12.4%
YL/ZP	11.35%	11.2%

This factor should be borne in mind when deciding on the proposed relocation of the plugs.

### Para 2. First Barrel Course.

The proposed cooling plug ahead of the clackbox along the top centre line of the boiler can be provided as shown on C.S.O. Sk. Nos. L-393 Alt. 1, 394 Alt. 1 and 395 Alt. 1 for all class of boilers.

While this can be done easily on new builds, in the case of the large number of existing boilers the cost of carrying out the modifications considered in relation to the advantages claimed, should be borne in mind. Attention is drawn to the fact that these boilers have been in service for a number of years with the present method of cooling and filling in.

### Intermediate Barrel Course.

No Comments.

#### Hind Barrel Course.

The inspection door on the left hand side, on existing WP,WG,WM,YP,YG,YL,ZP & ZE locomotives is above the top row of flue tubes. In the case of the existing WL, WW & WU boilers, the inspection door on the left hand side is below the top row of flue tubes and cannot be raised any further on account of the longitudinal barrel seam coming in the way. In the case of new builds of WL boilers the inspection door may be provided on the right hand side above the flues, and the mud door shifted to the left hand side in the present location of the inspection door.

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In the case of the "new build" WW and WU boilers, the inspection door can be raised above the flues on the left hand side.

### Para 3. Outer Firebox Throat Plate

The provision of mud doors in the flange corners of the outer throat plates of WP/WG and YP/YG boilers was approved, vide Para 7 of the minutes of the XXXIV LSC meeting CSL Drgs. Nos. 2175 and 2382 have been issued to Railways to modify existing boilers as opportunity offers. New builds are being provided in accordance with CSL Drgs. Nos. 2281 & 2388.

These doors cannot be relocated to a higher position. In the case of WL locomotives, these doors have not been provided, but can be located as shown on CSO Sk. No. L-393 Alt. 1.

### Para 4. Outer Firebox Wrapper Plate.

Three washout plugs of larger size, according to I. R. Part Drg. No. L/BM 633 have been shown on CSO Sk. Nos. L-393 Alt. 1 and 395 Alt. 1 on the outer wrapper crown to facilitate washout and inspection of the thermic syphon.

The proposal to provide only inspection doors in the top corner sections of the outer firebox casing plate cannot be adopted for existing WP, WP/P WG, YP & YG class boilers on account of the pitching of the crown stays. It is also not desirable to adopt this for new

builds of these boilers as failures of the crown stays in this location are already being reported, and any increase in the unstayed area may further tend to aggravate matters.

The existing doors along the top corner sections have been repositioned and the number has been increased as follows:

	Type of Door.	Existing No.	Increased to.
WP, WP/P, W	/G Mud door	1 R.H. & 2 L.H.	Existing Boilers.
· · · ·			3 R.H. & 3 L.H New Boilers— 2 R.H. & <b>3</b> L.H.
WL	Inspection door	1 R.H. & 2 L.H.	2 R.H. & 2 L.H.
YP & YG	Mud door	2 R.H. & 1 L.H.	2 R.H. & 2 L.H.

### Para 5. Firebox Backplate.

The proposal to replace the mud plugs along the mid sections of the flange radius on either side by mud doors has been incorporated in CSO Sk. Nos.L-393 Alt. 1 to 395 Alt. 1. It is, however, pointed out that this changeover will necessitate considerable alterations to the piping arrangements on the right side.

The two washout plugs at crown level on the ZE boiler have been shown in CSO Sk. L-394 Alt. 1, and can be adopted without difficulty.

### Para 6 (i) - Rearrangement of Spark Arrestor Netting in Smokebox.

The ERly proposal to relocate the spark arrestor screen in the smokebox in a horizontal plane ahead of the apron will result in reducing the free gas area to 85% (new screen) as against the present 130% (new screen). This cannot be done without detriment to the performance of the boiler.

The reason for ERly's proposal is mainly due to the difficulty experienced in Running Sheds to open the large number of pin and split cotter connections for the screen sections. This difficulty can be minimised by reducing the number of pin and split cotter connections in the vertical angle iron members of the screen frames.

- (ii) The CRIy's proposal to provide a suitable size flap in the cab floor plate to enable the rear foundation ring corner mud plugs begins utilised for washout and, at times, for inspection purposes, can be adopted and CSO Sk. No. L—400 has been prepared showing the arrangement for the WG locomotive. If accepted similar alterations can be made to the other classes of locomotives.
  - (iii) This has been noted by C.S.O. for future guidance.
  - (iv) No comments.
- (v) Investigations have been made to determine the possibilities of reducing the projection of the door seating on the water side so as to increase the arc of vision. No. further reduction in this height can be made unless the design of the seating is changed, in which case, the load on the seating will be taken up directly by the welding and not by the tapered collar provided in the existing design.
- (vi) If the Committee approves, Railway workshops can be requested to turn out a few boilers without copper ferrules and the tube ends welded without beading over, for trial purposes. A decision may be taken on the results of these trials.

### (vii) Beading of Tubes at Smokebox end.

The practice of beading over all the flues and some of the smoketubes at the front end has been introduced with the newer W and Y series of locomotives. This has been done in order to stay the proportionately thinner front tube plates. The proposal to eliminate this beading is therefore not recommended.

#### (viii) No comments.

(ix) CSO Sk. No. L-394 Alt. 1 shows the mud plug screwed to a stiffening plate riveted to the firebox corners. In this connection, the Committee's attention is drawn to Para 2 of the Minutes of the XXVII LSC Meeting, when it was decided to introduce the existing type of mud plug scating as Railways had reported boiler plates cracking through the tapped mud plug holes. In the arrangement shown on CSO Sk. No. L-399, however the boiler plated has not been tapped and it is, therefore, anticipated that similar cracks will not develop. This may be considered for adoption on future builds.

- (x) Since a barrel is twice as strong circumferentially as longitudinally, it has been the practice as far as possible, to keep the major axis of the mud door openings along the circumferential (or vertical) direction. Since with the introduction of the flat faced doors, the openings in the boiler plates are circular, there is no objection to the door axis being made horizontal if this will assist inspection and washout.
- (xi) Vide item 6 of Appendix II of the Minutes of the XXVI LSC meeting, it was decided that the foundation ring seams should be seal welded. This has also been incorporated in Cl 9 of R. 32. The advantage of this practice is that it eliminates the need for caulking in Running Sheds. The only disadvantage is that it is likely to cause a little additional work when the foundation ring requires to be removed. This is however, far outweighed by the advantage in service, and should therefore be retained.



APPENDIX-III (To item No. 89.)

GOVERNMENT OF INDIA MINISTRY OF RAILWAYS

# INDIAN RAILWAYS SCHEDULE AND PARTICULAR SPECIFICATION NO. L-7 OF 1955

FOR

LOCOMOTIVE (TANK) ENGINES

5'-6" Gauge

2-8-4 Type 'WH' Class

Central Standards Office For Railways

(Railway Board) CHITTARANJAN (Dist. Burdwan) India.

September, 1955



### INDIAN RAILWAYS

5'--6" Gauge

### SCHEDULE

Item No.	Quantity required	Description
1		LOCOMOTIVE (TANK) ENGINES, 5'—6" Gauge, 2-8-4 type, WH class, having coal capacity 6½ long tons and water capacity 4000 Imperial gallons; Maximum axleload 18.5 tons; Fitted with Side Tanks, Superheater, Walschaert Valve Gear with piston valves, and Roller Bearing Axle Boxes on carrying wheels only,
		the whole to be in accordance with—  (i) Indian Railway Particular Specification No. L-7 of 1955;
		<ul> <li>(ii) Indian Railway Standard Specification for Steam Locomotive Engines and Tenders, Serial No. R. 32-54;</li> <li>(iii) The Conditions of Contract issued by the Director - General, India</li> </ul>
·2	One set handmade tracings	Stores Department, London, or the Railway Board, India.  Complete set comprising of the following:—
-	& eight sets of reprintable mechanical copies, in trac-	(a) Photographic views; (b) Tracings of Index Sheet;
		(c) Tracings of drawings of the tank locomotive 'as made' according to Item 1 above, and as specified in Clause LXI of the Particular specification No. L-7 of 1955.
3		Spare parts listed in Appendix VIII of the Particular Specification No. L-7 of 1955.

Firms tendering must state whether they are quoting for SKF, Timken or Hoffmann roller bearings for the front truck and hind bogie axle boxes of the locomotives. The number of locomotives which shall be fitted with Hoffmann roller bearing axle boxes manufactured outside India, if prices are competitive, shall not exceed 20 per cent of the quantity on order.

The Standard Specification R. 32-54 calls for Acid Open Hearth steel for boilers, axles and tyres. Basic Open Hearth steel produced under stringent metallurgical control will be accepted in lieu. The firms tendering must state clearly whether they will use Acid Open Hearth or Basic Open Hearth steel for these parts and must also state below the amounts by which their tenders will be increased or decreased for supplying the alternative qualities of steel.

D -:1-	Acid Open riearth Steel		
Boile	Basic Open Hearth Steel		
Axles	Acid Open Hearth Steel		
Axies	Basic Open Hearth Steel		
Т	Acid Open Hearth Steel		
Tyre	Basic Open Hearth Steel		
with any	kmanship and Materials.—In the event of of any tenderer being unable to comply part of the requirements of the Particular or Standard Specification, it must be fically what variation therefrom is covered by the tender and where not so the tenderer will be held strictly to the conditions of these Specifications.		
	The tenderer shall furnish the following information:—		
	The steel boiler plates will be made by		
	The steel inside firebox plates will be made by		
. 2010	The arch tubes will be made by		
	The architudes will be made by		
	The superheater elements will be made by		
****			
4	The boiler tubes and superheater flue tubes will be made by		
•=••	The rigid waterspace stays will be made by		
y	The axles will be made by		
	The tyres will be made by		
****	The wheel centres will be made by		
••••	The roller bearings will be made by		
****	The frame plates will be made by		
	The general steel castings will be made by		
bas	The locomotives will be built at		
žet s	ed <b>ogs totage considerations</b> and the contraction of the contraction o		

#### INDIAN RAILWAYS

#### PARTICULAR SPECI ICATION No.L 7 OF 1955

for

### STEAM LOCOMOTIVE (TANK) ENGINES

5' 6" Gauge

### 2-8-4 Type 'WH' Class

#### Maximum Axieload- 18.50 Tons.

- 1. The locomotive (tank) engine required are described in the Schedu'e accompanying the tender documents and illustrated in CSL Drawing 2441 Alt. I appended to this Specification. The locomotives are to be built in accordance with the Indian Railway Standard Specification for Steam Locomotive Engines and Tenders, Serial No. R. 32-54, so far as it is applicable and with the requirements of this Particular Specification.
  - II. This Particular Specification is arranged in three parts as follows:—
    - PART A-relating to the drawings pertinent to this Particular Specification.
    - PART B—relating to modifications required to the Standard Specification applicable to all types of (tank) engines built in future; also embracing testing, packing, drawings and other general requirements.
    - PART C—relating to detailed engine design requirements in amplification of the provisions of the Standard Specification and in modification or explanation of the exhibited drawings applicable to the locomotive (tank) engines now required.
- III. The clauses of this Particular Specification are serially numbered in Roman numerals. The number of the clause or clauses of the standard specification to which each clause of this Particular Specification relates is shown in Arabic numerals below the serial number. The clauses in this Particular Specification either amplify or modify the requirements of the Standard Specification and/or the exhibited drawings.
- IV. Should it be found that this Particular Specification does not clearly indicate the applicability or otherwise of any individual requirement of the Standard Specification to the locomotive (tank) engines now required, or should there be any points of difference between the Standard Specification and the exhibited drawings not provided for in this Particular Specification, the Contractor must submit each item to the Director-General, India Store Department, London, or the Central Standards Office for Railways, Chittaranjan, for instructions.
- V. Copies of the Indian Railway Standard Specification for Steam Locomotive Engines and Tenders, No. R. 32-54, may be obtained on payment from the Office of the High Commissioner for India, Publications Branch, India House, Aldwych, London W.C. 2, or the Manager of Publications, Civil Lines, Delhi-8 (India).

#### PART A

### Relating to the drawings pertinent to this Particular Specification.

- VI. The drawings exhibited are listed in the appendices to this Particular Specification classified as follows -—
  - Appendix I. CSL Drawing 2441 Alt. 1 is a tentative outline of the 'WH' class locomotive (tank) engine now required and is given fer general guidance only.
  - Appendix II. 'As Made' Drawing Set E/SL-131. These drawings are exhibited as a guide to the practice to be followed generally as modified by the requirements of this Particular Specification.
  - Appendix III. 'As Made' drawings other than Drawing Set E/SL-131 illustrative of particular features to be embodied in the design of the locomotive (tank) engines now required in amplification or modification of the design shown in the exhibited drawings listed in Appedix II.
  - Appendix IV. Central Standards Office for Railways drawings of series 'CSL', 'LSC', CSO Sketches and IR Part Drawings illustrative of particular features to be embodied in the design of the locomotive (tank) engines now required in modification of the designs in the exhibited drawings listed in Appendices II and III.
  - Appendix V. Central Standards Office for Railways drawings of series 'CSL', 'LSC', CSO Sketches and Indian Railway Standard Part Drawings of series 'C', 'L', 'VB', or 'W' illustrative of a range of standardised dimensions and fittings to which the design of the locomotive (tank) engines now required must comply and from which the fittings included in the design must as far as possible be selected. Attention is drawn to the footnote at the end of Appendix V, regarding IRS part drawings not to be re-traced for inclusion in 'as made' sets.

The drawings will be placed on view at the Offices of the Director-General, India Store Department, London, and at the Central Standards Office for Railways, Chittaranjan. Copies of drawings may be obtained on payment by firms tendering for the work from the above source on production of this Particular Specification.

The drawings provided for the use of the Contractor are NOT GUARANTEED to be free from discrepancies, etc., and they must be modified in whatever points are stated in the Particular and Standard Specifications, or may subsequently be desired by the Director-General, India Store Department, London, or the Central Standards Office f r Railways, Chittaranjan, without claim by the Contractor for extension of time or increase of price, except as provided for under the Contract.

The Contractor whose tender is accepted must provide himself at his own expense with copies of the drawings exhibited, which copies can be used instead of the originals by the Contractor in preparing his working drawings.

Tenderers are warned that, from time to time, modifications are made in the drawings, and they must, therefore, satisfy themselves that any copies of the drawings quoted (which they have had previously) show all the latest modifications made to date.

The Constractor must prepare, before the work is commenced, at his own cost from these drawings, from the Particular and Standard Specifications, and from the instructions of the Director-General, India Store Department, London, or Central Standards Office for Railways, Chittaranjan, a complete set of working drawings, which are to be in every respect as shall be approved by them.

Reference is also invited to Clause 90 of the Standard Specification R. 32-54.

#### PART B.

### Relating to modifications required to the Standard Specification.

#### General Requirements.

VII. Sublet orders for materials.—Complete instructions as to submission of proposed Sub-Contractors' names for approval and furnishing copies of sublet orders may be obtained from the Director-General, India Store Department, London, or the Central Standards Office for Railways, Chittaranjan, on application.

Electric Arc Welding.—Reference Clause 3 of the Standard Specification, electric are welding must comply with a 'Code of Practice' approved by the Inspecting Officer.

The Railway Initial Letters for the marking of parts in compliance with Clause 6 and 86 of the Standard Specification shall be 'I.R.'.

Painting and Marking.—The locomotive shall be delivered finished painted black and varnished. Particulars regarding marking, and numbering of the locomotive engines, will be supplied later.

Shipment.—Details will be specified after contract is let.

Tracings.—One set of handmade tracings and eight sets of mechanical copies in tracing linen shall be supplied, for use in India not later than the delivery of the first locomotive under this contract.

VIII. Materials.—The latest revisions of IRS Specifications are indicated in Appendix VI.

The latest revisions of relevant British Standard and Directorate General of Supplies and Disposals Standard Specifications are indicated in Appendix VII.

Permissible alternatives are listed in Appendix IX.

IX. Spares.—Spare parts requirements are listed in Apendix VIII. These shall be supplied not later than the last locomotive delivered under this contract.



#### PART C.

### Detailed Engine Design Requirements.

The locomotive engines shall be manufactured in accordance with Indian Railway Standard Specification R. 32-54 except where departures are called for in this Particular Specification. CSL Drawing 2441 Alt. 1 shows a tentative outline diagram of 'WH' class locomotive now required. Dimensions and proportions indicated in this drawing are desired, but departures may be found necessary to suit design requirements. None of the features detailed hereunder shall be deemed as final pending approval of drawings.

The locomotive is required for heavy and medium shunting work in yards.

It is emphasised that increase on the specified maximum axleload is not permissible, and firms tendering must, therefore, satisfy themselves that the specified axleload can be adhered to without alteration to the basic design required.

Attention is drawn to Clause 8 of the Standard Specification regarding the strength of the boiler and its details.

In the clauses below, the term 'leading coupled axle' will refer to the coupled axle immediately behind the main steam cylinders. The 'trailing coupled axle' will refer to the coupled axle nearest the cab. The 'front truck' is the pony truck ahead of the leading coupled axle and the 'rear truck' in this case a bogie truck, will refer to the trailing bogie below the coal bunker. The 'driving axle' shall be the third coupled axle as shown in CSL Drawing 2441 Alt. 1, i.e. the coupled axle adjacent to the trailing coupled axle. The remaining coupled axle between the driving and leading coupled axles will be referred to as 'intercoupled axle'.

The following clauses indicate the principal requirements in the design of the locomotive engines now required.

### X. General Requirements and Dimensions.—(Clause 1 of Standard Specification)

Drawing reference: CSL Drawing 2441 Alt. 1.

Maximum moving dimensions ... The maximum moving dimensions permissible are shown in LSC Drawing No. 19 Fig. A.

Overall height from rail level ...

Not to exceed 13' 4" with locomotive in working order, i.e. with tanks and bunkers full, and not to exceed 13' 6" with tanks, bunkers and boiler empty.

Axleload ... Maximum permissible axleload: 18, 5 tons for all axles.

The leading pony truck axleload shall not be less than 9.00 tons with tanks and bunkers empty. The bogie axleload shall not be less than 9 tons with tanks and bunkers empty.

Gauge ... ... 5' 6"

Sharpest Curve ...

573 ft. radius. The engine must also be checked for passage over 1 in 8½ turnouts to Drawing TA-5062 Alt. 7. This investigation should be made with the engine moving in either direction with due consideration of the limits of coupled axle lateral play quoted in Clause XLVII of this Particular Specification.

Maximum weight per foot run of 2.96 tons. engine wheel base ...

Maximum weight per foot run 2.38 tons. over buffers.

Wheel arrangement ... 2-8-4.

Horizontal distance between centres of front truck axle and

leading coupled axle ... 9' 2".

Horizontal distance between centres of leading and intercoupled axles ... ...

5' 61"

	Horizontal distance between centres of inter and driving coupled axles	<b>\$'</b> 6½″
	Horizontal distance between centres of driving and trailing coupled axles	6′ 0″
	Horizontal distance between centre of trailing coupled axle and centre of trailing bogie pivot.	10′ 3″
	Wheel base of trailing bogie	7′ 0″
	Coupled wheels diameter on tread	4′ 3″
	Engine front truck wheels diameter on tread	3′ 0″
	Engine trailing bogie wheel diaeter on tread	3′ 7″
	Cylinders (Outside)	Two Nos.
	Length of piston stroke	26"
	Cylinder bore	20‡"
	Height & inclination of cylinder.	Longitudinal cylinder centreline shall be horizon- tal and shall be in the plane of the coupled axle centres.
	Lateral spacing of cylinder centrelines	7' 7" (approximate).
	Steam Ports	1½" wide.
	Water capacity	4000 Imperial Gallons (Minimum).
	Coal capacity	$6\frac{1}{2}$ long tons (Minimum).
Boll	er.	
	Height of boiler centreline above rail level	ह्यमे <b>व ज</b> यते 9' 2"
	Boiler barrel outside diameter—	
	Smokebox end	5′ 0″
>	Rear Course	5′ 14″
٠,	Boiler pressure	210 lbs/square inch
	Distance between tube plates	12′ 6″
	Smoke tubes	85 Nos; Outside dia. 2" x 11 SWG.
	Flue tubes	26 Nos; Outside dia. 5½" x 8 SWG.
	Elements (Superheater)	Superheater Co's 'A' type; 13" dia x 9 SWG,
		26 Nos.
	Arch tubes	3 Nos; 3" outside dia. x 7 SWG.
	Width of firebox internally, at level of grate	4' 0-5/8"
	Length of firebox internally, measured horizontally from front of foundation ring	6′ 8-1/8″
	Nominal grate area	27 Sq. ft.
All	studs screwed into the boiler	plates and seatings shall be 11 threads per inch

All studs screwed into the boiler plates and seatings shall be 11 threads per inch parallel Whitworth form and the portion for the nut shall be screwed BSW.

### XI. Boiler Barrel and front Tube Plate.—(Clause 10 of Standard Specification)

Drawing reference ... CSO Sketch L-353. E/SL 131/7, 8, 16. CSL Drawing 2441 Alt. 1.

The boiler shall be of the 'Belpaire' type generally as shown in the exhibited drawings-conforming with the particulars shown in CSL Drawing 2441 Alt. 1 and requirements-detailed in Clause X above.

The boiler barrel shall be in two parallel courses arranged telescopically.

The boiler plate for each course shall be 5/8" thick.

Boiler belly protection plates are not required.

The front tube plate shall be 1" thick and shall be secured to the boiler by an anglering following the practice in drawings E/SL 131/7, 8 and 16.

The layout of the front tube plate shall be generally as shown in CSO Sketch L-353.

XII. Dome Base and Dome.—(Clauses 11 & 12 of Standard Specification)

Drawing reference ... E/SL 131/12, 16.

The dame base and dame shall follow the practice of the exhibited drawings with modification as necessary to suit the diameter of the boiler barrel of the locomotives now required.

XIII. Mud Collector and Manhole .- (Clause 13 of Standard Specification)

Drawing reference ... IR Part Drawing L/BR-683. CSL Drawing 2241.

The mud collector and manhole seating shall generally follow CSL Drawing 2241 and the cover for the manhole seating shall be to IR Part Drawing L/BR-683.

XIV. Boiler Expansion and Steadying Brackets.—(Clause 15 of Standard Specification)

Drawing reference ... E/SL 131/2, 17, 18, 106. E/12703/18, 19, 20,21.

The boiler is to be supported at the front end under the circular smokebox by a saddle which may be cast steel or fabricated design, as explained in Clause 35 (b) of the Standard Specification R. 32-54.

The boiler shall be supported by grease lubricated expansion guides attached to the sides of the outside firebox and bearing on the main frame plates generally in the manner shown in Drawing E. 12703/21. Only one bearing slide is required on each side with its centre approximately above the compensating beam pintle support between the driving and trailing coupled axles. The grease nipple for the lubrication of these expansion slides shall be brought into an accessible location unimpeded by the side tanks.

In addition, a boiler steadying lug shall be provided generally as shown in Drawing E. 12703/20.

XV. Boiler Shell Stays, Belly Stays & Cross Stays.—(Clause 16 of Standard Specification)

Drawing reference ... E/SL 131/7, 10, 11, 17 to 19.

The cross staying of the outside firebox shell shall incorporate the details of Drawings-E/SL 131/7, 18 and 19 including the provision of reinforcement patches on the inside.

Longitudinal braces and belly stays shall also be provided, the design following generally Drawings E/SL 131 7, 10, 11, 17, 18 and 19.

XVI. Firebox (Including Brick Arch).—(Clause 17 of Standard Specification).

Drawing reference ... E/SL 100/33. E/SL 131/7, 17, 18, 27. CSL Drawing 234, 2441.

The inside firebox shall be in steel and of electrically welded construction. The inside firebox back and wrapper plates shall be 13/32'' thick and the tube plate shall be  $\frac{1}{2}''$  thick. The shape and size of the firebox shall approximate to the design shown in CSL Drawing 2441. Three security arch tubes shall be provided inside the firebox. The arch tubes shall be of the double bend pattern generally as shown in drawing E/SL 131/27. The arrangement of the arch tubes and brick arch shall generally follow Drawing E/SL 100/33.

The outer firebox shall be of the 'Belpaire' type. The thickness of the outside wrapper and back plate shall be 9/16". The thickness of the outer throat plate shall be 11/16".

The fire bricks shall be selected from the types shown in CSL Drawing 234.

XVII. Firehole and Foundation Ring. - (Clause 18 of Standard Specification)

Drawing reference ... E/SL 131/2, 18, 20, 21, 22. E/SL 217/25. E. 12703/20.

The foundation ring shall be 3" wide at the back and sides, and 3½" wide at the front end of the firebox. The ring shall also be provided with a boiler steadying lug at the back end as shown in Drawing E. 12703/20 and as required in Clause XIV of this Specification.

The foundation ring shall be single riveted with the firebox plates, except at the four corners where double riveting is required with the outside plates in accordance with Clause 18 of Standard Specification R. 32-54.

The bottom edges of the firebox plates shall be seam welded with the foundation ring and the seams between the firebox casing wrapper plate, throat and door plate, shall be sealed by continuous welding along the caulking edges of the plates for a distance of one foot upwards from the foundation ring as shown in Drawing E/SL 217/25.

The firehole arrangement and the flanging of the back plate shall follow Drawing E/SL 217/25.

The fire door arrangement and details shall be in accordance with Drawings E/SL 131/20 and 21.

The protector plate, Ref. Lett. C of Drawing E/SL 131/20 shall be modified to suit the width of firehole.

XVIII. Waterspace Stays. (Clause 19 of Standard Specification)

Drawing reference ... E/SL 131/17, 18, 19, 25.

The rigid waterspace stays shall be made 7/8" diameter over the screwed portion and 3/4" over the waist. Telltale holes 7/32" diameter are to be drilled to a depth of  $1\frac{1}{2}"$  in the stays from the outside (of firebox shell) end. The stays may be spaced 4" apart.

The material for rigid waterspace stays shall be selected from the following permissible alternatives:—

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Steel Class VI to IRS Specification M. 7.

Dunic Steel.

Long Strand Steel.

Stabol Novo Steel.

Titanic (Samuel Osborn).

Stag Super Fibre (Edgar Allen).

Flexible waterspace stays are to be fitted on the throat plate and in the breaking zones of the firebox sides and of the back plate to an extent comparable with the arrangement shown in Drawing E/SL 131/2. Attention is drawn to the restricted space between the firebox and the side water tanks for the accommodation of flexible stay sleeves and caps on the firebox side. It is preferred that these items shall be of the same design as shown in the exhibited drawings.

XIX. Firebox Roof Stays.—(Clause 20 of Standard Specification)

Drawing reference ... E/SL 131/1 /. E. 12885.

The roof stays shall generally follow the arrangement shown in Drawings E/SL 131/19 and E.  $128^{\circ}5$ .

Attention is drawn to Clause 20 of the Standard Specification requiring the provision of four rows of flexible stays at the forward end of the firebox crown.

XX. Tubes and Flues. - (Clause 21 of Standard Specification)

Drawing reference ... E/SL 131/10. C=O Sketch L-353.

The dimensions and number of tubes and flues shall be as detailed in Clause X. The arrangement of tubes and flues in the smokebox and firebox tube plates may tollow CSO Sketch L-353.

The manner of fitting the tubes and flues into the tube plates shall generally follow Drawing E/SL 131/10.

XXI. Fire Grates.—(Clause 22 of Standard Specification).

Drawing reference ... E/SL 217/58 to 61.

A hand-operated rocking grate of the finger patten shall be provided, following the arrangement and details in the exhibited drawings.

XXII. Ashpan.—(Clause 23 of Standard Specification)

Drawing reference ... E/SL 131/33, E/SL 121/29, 0, 31, 36, E/SL 217/64, 65. CSL Drawing 1936.

The ashpan shall be of welded construction and shall be suspended from the foundation ring following the practice shown in Drawing E/SL 121/29. The ashpan shall be of the single hopper type and the hopper door shall be so arranged that it is at least  $5\frac{1}{2}$ " above rail level in the open position.

Provision shall be made in the ashpan so that a minimum total area of 5.0 sq. ft. for air is obtained.

Provision shall be made for ashpan drench pipes as shown in Drawing E/SL 131/33 to be operated from either ejector.

The construction of the ashpan shall be such that ledges are not formed on which ash or cinders will accumulate.

The operating gear shall be generally similar to the design shown in Drawings E/SL 217/64 and 65 with the modification required in CSL Drawing 1936.

The spring at the rod end shown in Drawing E/SL 217/65 shall be protected from ashpan deposits.

XXIII. Smoke box and Chimney,—(Clauses 24 and 25 of Standard Specification)

Drawing reference ... E/SL 131/39 to 41, 48 to 52. E/SL 122/41 and 42. CSL Drawings 2441, 2161, 2162.

The smokebox shall be constructed of 3/8" thick plate. The outside diameter shall be 6'0\frac{2}" approx. and the length inside the smokebox shall be 6'0" with the centreline of the chimney and blast orifice located 3'6" ahead of the smokebox tube plate. The design shall be similar to the drawings exhibited, but shall suit the dimensions given in CSL Drawing 2441.

The table flap of the ash ejector apparatus shall be secured to the centre table by ring hinges as shown on CSL Drawing 2162.

The design of the smokebox door shall follow Drawings E/SL 131/40 and 41.

The front end layout of the smokebox shall be made to suit fall plates, and spark screens made from 'Draftac' or similar mesh to comply with the principles recommended by the American Master Mechanics for front end layout. The design may generally follow the drawings exhibited. The opening of the mesh shall not exceed 3/4" x 3/16".

The bore of the chimney shall be 1'  $5\frac{1}{4}$ " and the bottom edge of the petticoat shall be  $2\frac{3}{4}$ " above the boiler centreline.

A cast iron protector plate as mentioned in the Standard Specification shall be provided.

The headlight bracket on the smokebox shall be to Drawings E/SL 122/41 and 42, suitable for buffer lamp to CSL Drawing 2161, which is to be provided on smokebox as specified in Clause LV.

XXIV. Main Steam Pipes (Internal & External).—(Clause 26 of Standard Specification)
Drawing reference ... E/SL 131/39, 40, 42, 43, 44, 56.

The main internal steam pipe shall be of steel and shall have an inside diameter of 5½°, generally following the design shown in Drawing E/SL 131/56.

The smokebox steam pipes and external branch pipes shall be of cast iron and shall have an inside diameter of 6", generally following the design shown in exhibited drawings.

Steam pipe elbow to the smokebox shall be of cast steel.

The cylinder lubricating pipes shall be connected to the branch steam pipes as shown in Drawing E/SL 131/44.

As specified in Clause 80 of the Standard Specification, the provision of undrilled bosses for attachment, when necessary, of manometer and pyrometer, is required.

### XXV. Exhaust Pipes, etc., in Smokebox. - (Clause 27 of Standard Specification)

Drawing reference ... E/SL 131/46.

Separate exhaust pipes shall be provided on the lines of the exhibited drawing. The exhaust from the cylinders shall be such as to ensure an undistorted blast of steam through the orifice which is located in line with mid-stroke position of the cylinder.

The blast pipe cap and spreader shall be generally to Drawing E/SL 131/46, but the blast orifice shall be 5½" dia and located 20" below the boiler centreline.

### XXVI. Regulator —(Clause 28 of standard Specification)

Drawing reference ... E/SL 131/53 to 55.

A 'Joco' regulator similar to that shown in the exhibited drawings shall be provided in consultation with the manufacturers.

The regulator handle shall be of the 'Ramshorn' pattern generally as shown in the exhibited drawings. In the design of the regulator handle, consideration shall be given to the location of the sight feed lubricator, so that the movement of the regulator handle will not hamper in any way the adjustment of the lubricator.

### XXVII. Safety Valves and Seat .- (Clause 29 of Standard Specification)

Drawing reference ... E/SL 131/78.

Two Ross Pop pattern safety valves of 3" nominal diameter of the design shown in the exhibited drawings, shall be provided.

### XXVIII. Injector, Clack Valves and Pipes. -(Clause 30 of Standard Specification)

Drawing reference ... ... CSL Drawing 1718. E/SL 131/64, 73, 76, 82. IR Part Drgs. LA/BM-155 & 160.

Two 'Simplex' pattern 9 m/m injectors shall be fitted, special attention being given to accessability for maintenance.

Steel pipes are to be used to the greatest extent possible but the number of different sizes shall be limited and selected from Table I of IRS Specification W. 3. The number of pipe unions employed is to be reduced to the minimum, except for the injector delivery pipe which shall be in at least three sections to facilitate cleaning. Each of these sections should be as straight as possible, so that the bore of the pipe from end to end may be examined visually. Care must be taken that the steel pipes are not sprung into position for assembly with the boiler mountings, that is, the pipes shall be properly bent to fit easily into position.

The injector overflow pipes shall be fitted so that the point o' discharge is visible from the cab.

The top feed clack box shall be of the design shown in CSL Drawing 1718.

Ashpan drench cocks shall be 1' globe valves to IR Part Drawing LA/BM-155 with take-off from the injector. The valves shall be operated from the cab footplate and shall be located below the platform, with sufficient clearance between the valves and the platform to facilitate attention to the packing glands.

The coal watering cock shall be a  $\frac{1}{2}$ " globe valve to IR Part Drawing LA/BM-160 with take-off from the injectors. The valve shall be operated from the cab footplate and located below the platform similar to the above.

### XXIX. Injector, Steam Cocks and Valves. (Clause 30 of Standard Specification)

Drawing reference: E/11673/53, 56. E/SL 127/78.

The injector steam cock shall be provided on the steam stand with operating gear on the lines of Drawing E/SL-127/78.

Two injector steam valves shall be provided on the back-head of the boiler following the design and arrangement shown in Drawings E/11673/53 and 56. The valve shall be provided with renewable seat on the lines of Ref. Lett. D of Drawing E/SL 127/78.

### XXX. Superheater. (Clause 31 of Standard Specification)

Drawing reference: E/SL 137/57 to 59.

IR Part Drawing LA/SX-153.

The superheater header shall be designed in consultation with the manufacturers of the superheater elements and shall be generally to the exhibited drawings.

Though a pyrometer is not required, the superheater header shall have a boss cast on it, drilled and tapped to suit the standard pyrometer, and closed with a plug encased as shown in the exhibited drawing.

Superheater Co's 'A' type elements, 1.3/8" diameter, with integrally forged return bends and spherical ends shall be fitted.

Shields are not required on the elements.

The anti-vacuum valves shall be to IR Part Drawing LA/SX-153.

XXXI. Boiler Mountings, Fittings and Seatings. (Clause 32 of Standard Specification).

Drawing reference:

E/SL 131/23, 67 to 83.

E. 12703/18, 19.

CSL Drawings 1582, 1984, 2163, 214: IR Part Drawings LA/BR-151, 169, 171,

LA/BM-183.

The location of mud hole doors and washout plugs shall be as shown in CSL Drawing 1582 generally following the requirements of BESA 4-6-0 locomotives. Flat-faced inspection and mud hole doors in conjunction with circular seats as shown in IR Part Drawings LA/BR-171 and 169 shall be provided on the curved surfaces of boiler and firebox. Where mud doors can be provided on flat surfaces on throat and back plates, circular seatings are not required. The mud door for these locations shall be in accordance with IR Part Drawing LA/BR-151 and the opening for the mud hole door shall be made 3 5/32" x 2 13/32".

Mud doors with circular seatings in lieu of washout plugs shown in CSL Drawing 1582 shall be provided on the corners of firebox above the foundation ring and also at about 1'-6" above the foundation ring on the lines of Drawings E. 12703/18 and 19. The mud door near the foundation ring should be located as low as possible so that rods used for washing out can clear the foundation ring of all scale.

A filling plug shall be provided ahead of clack box, on the front boiler barrel as shown in CSL Drawing 214.

It may be noted that holes in the main frame will not be permitted for passage of cleaning rods over the front of the foundation ring.

Bossed seating wherever provided shall generally follow Drawing E/SL 131/23. Inspection doors, mud hole doors, washout and fusible plugs, arch tube plugs, water gauge column protectors, and blow-through cocks shall be in accordance with IR Part Drawings listed in Appendix V.

The operating levers for blow-off cocks and the discharge pipe outlets shall be on the lefthand side of the locomotive and the operating handles shall be located at about 3 feet from the discharge pipe outlets in order that the operator may not be scalded.

The discharge end of the pipes from the blow-off cocks shall be provided with adaptors for connection to the shed hot water washout plant lines. The adaptor shall follow the design shown in Drawing E/SL 131/77.

The water gauge column cocks shall be in accordance with Drawing E/SL 131/75.

Steam cocks on the steam stand shall be screw-operated globe pattern valves, following the practice shown in the exhibited drawings. The valves shall be selected from IR Part Drawings listed in Appendix V.

Spindles for operating these cocks shall be provided, for easy operation from the cab.

The steam stand shall generally follow the design shown in Drawing E/SL 131/69. Provision shall be made in the design for the accommodation of clbows/cocks for steam brake-connection and also globe pattern valves. The end walls of the steam stand shall be drilled and tapped to suit the size of injector steam cocks specified in Clause XXIX.

The ejector steam cock shall be in accordance with IR Part Drawing LA/BM-183.

A combined blower connection and tube cleaner cock on the lines of the design shown in Drawings F SL 131/74 and 79 shall be provided on the smokebox.

A scum cock is not required.

A continuous blow down valve is not required. But a seat on the boiler back for fitting a continuous blow down valve shall be arranged complete with study and closed with a blank flange secured by study, nuts and joint rings.

Soot blowers and operating steam valves are not required, but provision shall be made for steam connection for tube cleaning from the blower steam valve on firebox back. The blower and tube cleaner connection shall be generally of the type fitted on smokebox side.

A four-feed Wakefield A.C. type lubricator having 5-pint capacity complete with steam valve mounted on the lubricator shall be provided. A lubricator steam cock shall also be provided on the steam stand. An independent condenser is required and shall be located in the standard of the steam of the standard of the stan inside the cab as shown in Drawing E/SL 131/67.

A Detroit five-feed hydrostatic lubricator having 5-pint capacity with additional IR globe pattern valve fitted at location shown in CSL Drawing 1984, will be accepted as an alternative to the Wakefield A.C. lubricator with separate condenser.

The whistle, whistle cock and operating gear shall be to the design shown in Drawing E/SL 131/70. The whistle connection shall be in accordance with CSL Drawing 2163.

A drifting valve on the lines of the design shown in the exhibited drawings, shall be fitted.

The vacuum brake ejector shall be of the 'SJ' pattern righthand 'G' type outside fixing, with Gresham & Craven graduable automatic steam brake valve. Davies & Metcalfe 'M' type ejectors will be accepted as alternative to the 'SJ' type but shall be fitted with Gresham & Craven graduable automatic steam brake valve.

A standard design of boiler pressure gauge shall be provided, as shown in the exhibited drawings.

A Duplex vacuum gauge of standard pattern shall be provided.

### XXXII. Boiler Clothing.

(Clause 33 of Standard Specification)

Drawing reference:

E/SL 131/42, 84 to 89. CSL Drawing 2441.

Stream-lining of the engine is not required. The cab front plates shall be splayed off at the corners as indicated in CSL Drawing 2441.

The clothing arrangement shall follow the exhibited drawings, but shall be adopted for the locomotive now required.

The casing of steam pipes from the smokebox to the cylinder shall be generally as shown in the exhibited drawings.

Insulating clothing in the form of asbestos mattresses is to be applied on firebox back plate, on the portion of wrapper plate in the cab and on the wrapper plate for a distance of 1'0" ahead of the cab front plate. Insulating clothing is not required on any other part of the boiler.

## **Main Frame, Buffer Beams, Cattle Guards & Drag Boxes.** (Clauses 35, 36 and 37 of Standard Specification)

Drawing reference:

E/SL 131/2, 3, 90 to 99, 102 to 106. E/SL 122/92, 93, 96, 102. CSL Drawing 2064.

The main frames are to be constructed from steel plate 1.3/8" thick, in accordance with Clause 35 (b) of the Standard Specification. The width between frames from the front end of the cylinders to the stretcher casting behind the boiler shall be 4'8\frac{2}{3}". Outside this portion of the frame, tho two side frames shall converge towards the rear buffer beam on the lines shown in Drawings E/SL 131/2 and 3, in order to ensure that the hind truck wheels will be able to take their full lateral movement without fouling the main frame. able to take their full lateral movement without fouling the main frame.

The frames shall be adequately braced by cross-stretchers and racking plates to with-stand lateral bending loads. The racking plates shall extend from the smokebox to the stretcher below the front of the foundation ring, and shall be secured firmly to each of the stretchers. Racking plates shall also be provided between the transome above the trailing bogie and the cross stretcher below the back end of the boiler foundation ring. Owing to the presence of an ashpan, it will not be possible to provide racking plates below the firebox but as this is the zone in the frame subjected to the maximum bending movement under lateral loading, provision shall be made for the reinforcement of each frame plate between the drive loading, provision shall be made for the reinforcement of each frame plate between the driving horn and the cross stretcher beneath the end of the foundation ring. This reinforcement shall be accommodated between the inside of each frame and the ashpan. The stretcher in between the frames above the railing bogie shall be of steel casting adequately reinforced around the openings to obviate the fractures reported with the fabricated structure shown in Drawings E/SL 131/91 and 93, on WM locos. The construction of the frame near the front and hind buffer beams shall also be of robust design to withstand impact loads experienced under rough shunting.

The horn gaps in the main frames shall be made for the accommodation of composite cast steel axle boxes as specified in Clause XLVII.

As stated in Clause XLVII, cast steel axle box guides shall be provided including wedges.

Rail guards shall be provided at both ends of the locomotive as shown in Drawings E/SL 122/92, 93 and 102. A certain number of locomotives shall, however, be provided with cattle guards generally as shown in Drawing E/SL 131/97. The number of locomotives which will be so fitted will be advised later.

The smokebox saddle will serve both as a cross-stretcher between the cylinders and as a support for the smokebox, and shall follow Drawing E/SL 131/106.

The screw coupling hook shall be as shown in CSL Drawing 2064 welded to the buffer beam.

In designing the main frame, special attention shall be given to the need for providing adequate supports for the side tanks. The entire design of frame and stretcher castings shall be submitted for approval.

### XXXIV. Cylinder.

(Clause 38 of Standard Specification)

Drawing reference: E/SL 113/156.

E/SL 131/107, 108, 111, 113, 116 to 119.

IR Part Drgs. L/CL-615, 616, 728, 729.

LA/CL-153.

6WG88.

CSL Drawing 2227

Two outside cylinders designed with a 20½" bore and suitable for 26" stroke shall be provided. The cylinders shall be in cast iron fitted with cast iron barrel liners and shall incorporate the features shown in the exhibited drawings. The steam chest shall be fitted with cast iron liners designed for a 10" diameter piston valve with 1½" wide rectangular steam ports and having the three bottom port bridges not less than 1" in width. The steam inlet connection on top of the steam chest shall be suitable for branch steam pipes 6" bore.

The cylinder barrel liner shall, in addition to the interference fit, be secured against movement by the combined plug and lubrication connection shown in CSL Drawing 2227.

Both cylinders shall be interchangeable.

Cast iron piston rod packing similar to the packing shown in Drawing 6WG88 shall be provided. As an alternative to this packing, Paxton Mitchell packing will be acceptable provided a common design of cylinder cover is practicable.

The cylinder front cover and lagging plate shall be in accordance with IR Part Drawings L/CL-728 and 729. The cylinder studs shall be pitched to suit the above design of cylinder front cover. The cylinder front cover joint ring shall bear both on the barrel liner and on the cylinder casting generally as shown in Drawing E/SL 131/111.

The cylinder hind cover shall be a steel casting and shall be designed on the lines of Drawings E/SL 113/156.

The steam chest front and hind covers shall be designed on the lines of IR Part Drawing L/CL-616 and 615 respectively.

The cylinder drain cock shall be in accordance with IR Part Drawing LA/CL-153 and the drain cock with operating gear shall follow generally the exhibited drawings.

The cylinder shall be insulated as approved by the Inspecting Officer, and shall be caused with suitable steel sheet.

#### XXXV Sli e Bars.

(Clause 39 of Standard Specification)

Drawing reference: E/SL 113/158.

The slide bars shall be designed for "Laird" type of crosshead specified in Clause XXXVIII below.

XXXVI. Pistons.

(Clause 40 of Standard Specification)

Drawing reference: E/SL 126/168.

IR Part Drgs. L/PX-622, 625.

The piston head shall be of the design shown in Drawing E/SL 126/168. Piston head and bull ring shall be in accordance with IR Part Drawing L/PX-625 a d 622.

XXXVII. Piston Rods.—(Clause 41 of Standard Specification)

Drawing reference:

IR Part Drg. L/PX-601.

The piston rod shall be designed on the lines of IR Part Drawing L/PX-601.

XXXVIII. Crossheads And Gudgeon Pins.—(Clause 42 of Standard Specification)

Drawing reference:

CSL Drawing 1694.

The crosshead shall be of the 'Laird' pattern designed in cast steel with integral crosshead arm suitable for double taper piston rod crosshead connection and fitted with cast iron slipper block lined with anti-friction metal, generally as shown in CSL Drawing 1694. Other components of the crosshead shall be to IR Part Drawings listed in Appendix V.

XXXIX. Piston Valves, By-Pass Valves, & Cylinder Relief Valvs.—(Clause 43 of Standard Specification)

Drawing reference: IR Part Drgs. L/PV-601.

LA/CL-154, 151, 152

The piston valves shall be of the piston type plug pattern fitted with four rings, each 5/16" wide, following IK Part Drawing L/PV-601, and shall be designed for 1/8" lead, 1½" steam lap, 'nil' exhaust clearance and a maximum travel of not more than 5½", giving in fore and back gear a cut off of at least 82 percent.

NC by pass valves shall be fitted, to the design shown in IR Part Drawing LA/CL-154.

Cylinder relief valves shall be in accordance with IR Part Drawings LA/CL-151 and 152.

XL. Valve Spindles And Valve Crossheads.—(Clause 44 of Standard Specification)

Drawing reference:

E/SL 131/112, 129.

6WG100.

IR Part Drgs. L/PV-606, 607.

The valve spindle crosshead shall generally be in accordance with IR Part Drawin L/PV-606 and the valve spindle shall be generally to Drawing 6 WG 100 modified as necessary to suit the design of piston valve. Piston valve cotter shall be in accordance with Drawing L/PV-607.

4" thick ground washers shall be introduced between valve spindle collars and the valve heads to facilitate adjustment, generally as shown in Drawing 6WG 100.

XLI. Motion: Walschaerts Type. - (Clause 45 of Standard Specification)

Drawing reference:

E/SL 131/120 to 140.

E. 12703/143.

IR Part Drg. L/MN-611.

The valve motion shall be of the Walschaerts type designed to give 1/8" lead, 1½" steam lap and 'nil' exhaust clearance with a steam port width of 1½" in full gear position whether working in fore or back gear. It is particularly important that the design should be such that the events are approximately equal in fore or back gear.

The valve motion shall be arranged for lubrication by soft grease

The quadrant link trunnion bushes shall be of the collar type as shown in Drawing E/SL 131/134.

Die block lubrication shall be soft grease from a single nipple feeding grease into three points generally as shown in Drawing L/MN-611. The clearance between the die block and pin shall range between 0 004" to 0.005".

A suitable roller bearing of the SKF or Timken design shall be provided at the return crank end of the eccentric rod.

If SKF roller bearings are fitted, the eccentric crank journal shall have a screwed end in order to secure the roller bearing on the journal by means of a nut generally asshown in Drawing E. 12703/143.

All motion pins shall be of the parallel type in accordance with IRS practice and areto be secured by solid taper pins. The motion pins shall be lubricated by soft grease, the arrangement following the exhibited drawings.

Motion pin holes shall be bushed with phosphor-bronze to IRS Specification N6, Class I.

In order to minimise the strain caused by frequent manipulation of the reversing gear, it is desired that the reversing screw shall be revolved by means of a rapid motion gear drive with improved mechanical advantage over the standard arrangement. The proposed design shall be submitted for approval.

### XLII. Connecting and Coupling Rods.

(Clauses 47 and 48 of Standard Specification)

Drawing reference: IR Part Drgs. LA/CR-153, 152-

With the wheel arrangement shown in CSL Drawing 2441, it will be possible to use connecting and coupling rods complete with all details of WG class locomotive shown in IR Part Drawings LA/CR-153 and 152. If revised designs are necessary to suit any modification to the spacing of the coupled axles, drawings shall be submitted for approval.

### XLIII. Coupled Wheels.

(Clause 49 of Standard Specification)

Drawing reference:

E/SL 127/214.

E/SL 122/140.

CSL Drawings 2318, 2145.

The coupled wheel centres shall be of cast steel, spoked pattern, generally as shown in Drawing E/SL 122/140. The design of wheel centres shall be modified to take balance weights on the lines shown in Drawing E/SL 127/214.

Bronze wear liner as shown in CSL Drawing 2318 applicable for WG locos shall be provided on the crank pin boss of driving coupled wheel.

The coupled wheel hub liners in halves are to be of 11 to 14 per cent manganesesteel, secured by copper set screws following the practice shown in CSL Drawing 2145.

The revolving masses shall be balanced to the maximum possible extent. Owing to the restricted dimensions of coupled wheel centres reciprocating masses be balanced on leading, inter and trailing coupled wheels only. The entire calculations for balance including cross-balancing shall be submitted for approval and a copy shall be included in the 'as made' drawing set.

#### XLIV. Axles.

(Claure 50 of Standard Specification)

Drawing reference: E/ L 127/223.

The design of coupled axles shall generally follow the exhibited drawing. In addition to complying with the requirements of IRS Specification R-18, the following shall also be complied with:—

- (i) The axles shall be forged to profile and machined.

  The minimum reduction from ingot size to the forged diameter at the journal portion shall not be less than 3 to 1
- (ii) The test piece for physical tests shall be taken at a section midway between the centre and surface of the axle.

### XLV. Crank Pins.

(Clause 51 of Standard Specification.)

Drawing reference:

E/SL 127/230.

...

CSL Drawing 1926.

IR Part Drgs. L/WL-608 609, 637.

L/MN 621.

It is preferred that the crank pins shall be identical with the designs fitted on WG locos and be suitable with the coupling and connecting rod drawings referred to in Clause XLII above. Kelevant drawings for the crank pins are as under:—

Leading crank pin

... CSL Drawing 1926.

Inter Crank pin

... IR Part Drg. L/WL-608.

Driving crank pin

L/WL-609.

Trailing crank pin

" L/WL-637.

If any modification is necessary, revised drawings shall be submitted for approval.

The return crank shall be generally to IR Part Drg. L/MN-621 modified as required in clause XLI, to suit the design of roller bearing.

#### XLVI. Tyres.

(Clause 52 of Standard Specification)

Drawing reference:

E/SL 131/144, 146, 147.

IR Part Drgs. L/TY-608, 609, 624, 625.

All wheels of the locomotive shall be fitted with tyres waich are secured to the rims by side rivets as shown in the exhibited drawings. The leading and trailing coupled wheel tyres shall be in accordance with IR Part Drawing L/TY-608. The intermediate coupled and driving wheel tyres shall have thin flanges and be in accordance with Drawing L/TY 609. The tyre profile for the front truck and bogie wheels shall be in accordance with Drawings L/TY-624 and 625 respectively.

Distance between tyres shall be 5'  $3''\pm 1/64''$  for the leading, and trailing wheels, 5' 31''+1/64'' for the driving and intermediate wheels, and 5'  $2.27/32''\pm 1/64''$  for the carrying wheels, measured at a distance of 3/4'' from the tip of the flange.

### XLVII. Coupled Axle Boxes And Guides.

(Clauses 53 & 54 of Standard Specification)

Drawing reference:

E/SL 131/148, 152, 154.

CSL Drawings 2056, 2164, 2428, 2429, 2430, 2355.

IR Part Drgs. LA/AB 157-158.

The coupled axle boxes shall be of the composite type having a cast steel body with pressed in bronze bearing generally as shown in IR Part Drawings LA/AB-157 and 158, with the following features incorporated:—

- (a) The axle box top shall be similar to Drawing E/SL-131/148 in order to take the type of bearing shoe to Ref. Lett. 'D' in Drawing E/SL 131/154.
- (b) The axle journal shall be lubricated by oil instead of grease. The oil lubrication shall be arranged through a crown feed as shown in CSL Drawings 2428 and 2429, and from the cotton waste packing retained in the keep which shall be of the repackable type.
- (c) The lubrication of the coupled axle boxes and the axle box sides shall be arranged through feed pipes connected to oil boxes located on the frame between the axle boxes at an accessable position. The oil shall be carried by steel pipes and electric hose rubber connections generally as shown in CSL Drawings 2430 and 2056 exhibited for guidance.
- (d) The total lateral play initially of the coupled axles in main frame shall be 7/32", which is equal to twice the axle box flangeway and hub clearances provided at each side of the locomotive.

The axle box guide shall be in cast steel and of the continuous type designed on the lines of Drawing E/SL 131/152. Wedges shall be provided as shown in this drawing. The faces of the guides bearing against the axle box shall be fitted with 11 to 14 percent manganese steel liners and the method of securing the liner shall follow the practice illustrated in CSL Drawing 2164. The wedge adjusting bolt shall be designed generally as shown in CSL Drawing 2355.

### XLVIII. Bearing Springs and Compensating Gear.

(Clause 55 of Standard Specification)

Drawing reference: E/SL 131/154 and 158.

The laminated bearing springs for coupled axle shall consist of 14 plates  $4\frac{1}{2}$ " wide x 1/2" thick, and shall have effective span of 44". The spring shall be provided with standard nibs and slits as shown in the exhibited drawing. The spring buckles shall be of the type shown in Drawing E/SL 131/154. The spring plates shall be of silico-manganese steel oil hardening quality.

The coupled axle bearing springs shall be overhung. All the bearing springs for coupled axles on either side of the locomotive shall be compensated. The locomotive shall therefore have a 4-point suspension, the end points being the front truck and hind bogie pivots and the two middle points being the compensated groups of the righthand and lefthand side coupled wheel bearing springs.

Auxiliary springs are not required.

The compensating beam pins shall be lubricated by soft grease.

### XLIX. Platforms Splashers.

(Clause 56 of Standard Specification)

Drawing reference: E/SL 131/90, 94, 100.

The designs may generally follow, the exhibited drawings.

### L. Footsteps, Handrail, Cab, Etc.

(Clauses 57 and 58 of Standard Specification)

Drawing reference: E/SL 131/171, to 181 and 103. CSL Drawing 2441.

The arrangements may generally follow the exhibited drawings.

Special consideration shall be given to the design of lookout windows at each end of the locomotive to ensure that the visibility is good.

The cab handrail towards the boiler side shall be as shown in CSL Drawing 2441.

### LI. Sand Boxes and Gear.

(Clause 59 of Standard Specification)

Drawing reference: E/SL 131/2, 3, 119, 199 to 202

 $E/SL\ 127/278$  to 280, 283 to 286.

LSC Drawing 19.

Gravity dry sanding shall be provided with the sand led to the front of the leading coupled and to the back of the trailing coupled axles.

Sand boxes may be located on top of the boiler barrel if required and the arrangements and operating gear may follow generally the exhibited drawings.

It shall be ensured that the brackets for the sand pipes do not foul the limiting dimensions shown in LSC Drawing 19 Fig. A.

### LII. Buffing and Draw Gear.

(Clause 60 of Standard Specification)

Drawing reference: E/SL 131/90, 91, 94, 212 & 213. IR Part Drgs. LA/BD-153, WA. 1.

The engine side buffers to IR Part Drawing LA/BD-153 shall be provided at either end of the locomotive, and screw coupling drawgear as indicated in the exhibited drawings shall be fitted.

The screw coupling shall be in accordance with IR Part Drawing WA1.

#### LIII. Brakes.

(Clause 60 of Standard Specification)

Drawing reference: E/SL 131/203 to 211.

E/SL 127/289.

The engine shall be provided with steam brake equipment and brake gear. The steam brake cylinder shall be generally as shown in Drawing E/SL 127/289.

The percentage of braking power to weight on the coupled wheels shall not be less than 75 percent of the adhesive weight of engine in working order with tanks and bunkers full.

Provision shall be made for a vacuum brake ejector and for the operation of the automatic vacuum brakes on the train. Vacuum brake fittings shall be selected from the IRS fittings shown in IRS Part Drawings of 'VB' series listed in Appendix V.

A hand brake shall also be provided in the cab as indicated in the exhibited drawings.

Brake blocks in cast iron are to be provided.

Safety straps shall be provided for brake pull rods and cross beams.

### LIV. Front Truck and Rear Truck.

(Clause 63 of Standard Specification)

Drawing reference: E/SL 131/151, 165 to 170.

E/SL 113/196, 205, 207, 208, 210, 248 to 254.

E/SL 126/254, 255, 258 to 260.

6 WG 108

CSL Drawings 1798, 2184 to 2188, 2252.

IR Part Drgs. L/TY-624, 625; TA-5062.

The front truck shall be of the Bissel type with a combined swing link and spring control designed on the lines of CSL Drawing 2184 to 2188, and Drawings E/SL 113/196, 205,207, 208, 210, 248 to 254. The lubrication of the swing link shall be arranged as shown in CSL Drawing 1798.

The radial arm shall be either a fabricated design or a steel casting.

Provision shall be made for lateral movement each way of  $3\frac{1}{2}$ ". The initial control shall be 2 tons effective at wheel/rail, and the final control at the maximum lateral movement of  $3\frac{1}{2}$ " shall not exceed 5 tons. The design shall provide for a further movement of 1/2" each way before the control springs are fully compressed. Side stops shall be provided to restrict the movement of the truck to a maximum of  $4\cdot 1/8$ ".

The front truck wheels shall be of the composite type with rolled steel wheel centre and riveted on tyre as shown in Drawing 6WG 108. The wheel shall be 3'0" diameter over tread with the tyre profile conforming to IR Part Drawing L/TY-624.

The front truck axle shall have inside journals fitted with roller bearings in cannon axle box of the split type, which shall have side flanges for bolting on to the radial arm.

The rear truck of the locomotive shall be similar to the design of bogic fitted to WM class locos shown in Drawings E/SL 131/165 to 170, incorporating the following modifications:—

- (a) The bogie frame plates shall be 1½" thick, joined together by cast steel cross stretchers designed to withstand the lateral loads and to overcome the fractures now experienced on the bogies of WM class locomotives.
- (b) The bogic horizontal slides shall be fitted with steel liner resting on top of bronze liner secured to the stretcher casting. The bogic vertical slides shall also be fitted with steel liner in contact with bronze liner.
- (c) Friction fabric liners are not required, except on the bogie pivot for which a fabric liner shall be used in contact with the steel liner fitted to the top pivot.
  - (d) Oil lubrication shall be arranged for the bogic horizontal slide and vertical liners.

(e) The bogic shall have a lateral movement each way of  $3\frac{1}{2}$ ", resisted by control spring arrangement on the lines of Drawings E/SL 126/254, 255, 258 to 260. As shown in this drawing, the spring shall be placed fore and aft of the pivot and located slightly above the plane of the bogic axle centres. The initial control shall be 2.5 tons and the final value shall not exceed 4.0 tons when the bogic is displaced  $3\frac{1}{2}$ ".

The lateral play between bogie axle box flanges and the axle guides shall be reduced to the minimum required for assembly purposes, and the axle box flanges shall be barrelled complying with the features shown in Drawing E/SL 131/151.

The adequary of the front truck and trailing bogic lateral movement shall be verified in both forward and reverse direction while negotiating 573 ft. radius curve and 1 in 8½ turnout to Drawing T A-5062.

The bogie axles shall have outside journals fitted with roller bearing axle boxes.

The bogic wheel shall be of the composite type with rolled steel wheel centre and riveted on tyre as shown in CSL Drawing 2252. The wheel shall be 3'7" in diameter over tread with tyre profile conforming to Drawing L/TY-625.

The axle guides of the trailing bogie shall be cast steel, lined with 11 to 14 per cent manganese steel on the faces bearing against the roller bearing axle box. The axle boxes faces shall also have wear liners of the same material and the contact faces shall be lubricated by oil.

The roller bearings both for the front truck and trailing bogie shall be selected from one of the following makes:-

- (i) Timkon,
- (ii) Skefko,

and (iii) Hoffmann.

The number of locomotives which shall be fitted with Hoffmann roller bearing axleboxes manufactured outside India shall not exceed 20 per cent of the quantity on order.

The lateral control springs shall be designed for a maximum home load stress of 40 tons/sq. in., with Wahl's correction. Spring coil sections shall be selected from step sizes of 1/16", i. e. 1/2", 9/16", 5/8", 11/16" and so on. The springs shall be coiled using ground bars and shot peened.

#### LV. Lighting and Electrical Equipment.

(Clause 64 of Standard Specification)

Drawing reference: E/SL 122/1.

E/SL 131/227.

CSL Drawing 2161.

IR Part Drg. C- 1642

Electric lights are not required to be provided. Three buffer lamps at each end of the locomotive shall be provided at locations shown in Drawing E/SL 122/1.

Oil burning buffer lamps to CSL Drawing 21-1 complete with burner to IR Part Drawing C-1642 shall be provided in accordance with Clause 64 of the Standard Specification. Other oil burning lamps shall be provided as shown in the exhibited Drawing E/SL 131/227.

#### LVI. Tools and Outfit.

(Clause 65 of Standard Specification)

Drawing reference: E/SL 131/228 to 232.

IR Part Drgs. LA/EQ-151, 152.

A complete set of tools in two separate tool boxes shall be supplied.

Screw jacks are not required.

For spanner sizes a full range of appropriate sizes for the bolts and nuts employed on the locomotive, shall be provided.

Firing shovel shall be to IR Part Drawings LA/EQ-151 and 152.

## LVII. Bolts, Nuts, Set Screws, Piped Couplings and Connections.

(Clause 82 of Standard Specification)

Drawing reference: CSL Drawing 1720.

IR Part Drg. LA/PC-55 to 59.

All screw threads throughout the engine shall be to Whitworth Standard form.

Bolts and nuts for all driven bolts, hind and front cylinder cover studs, horn stays and mud hole doors and covers, boiler mountings, roof stays, for securing engine cab to frame, steam joints in smokebox, regulator head and fastening to main steam pipe, steam pipe to cylinders, dome covers and slide bars, shall comply with BS Specification 28 or 190 as required. Other applications may be according to BS Specification 916 or 1083.

The pipe connections and couplings shall be of the standard type shown in CSL Drawing 1720 for copper pipes upto 1½" diameter and Drawings LA/PC-55 to 59 for copper pipes above 1½" diameter and all steel pipes.

#### LVIII. Lubrication.

(Clause 84 of Standard Specification).

Drawing reference: CSL Drawing 1680.

Auxiliary oil boxes and soft and hard grease nipples shall be of the design shown in the IR Part Drawings listed in Appendix V of this Particular Specification. Grease nipples of approved make conforming to dimensions shown on CSL Drawing 1680 will be accepted in lieu of those shown in IR Part Drawings.

Grease nipples and adaptors whenever used shall be tack welded.

Cylinders and Valves

Coupled axle boxes

Carrying axle boxes

Bigends & coupling rods.

Motion

Axlebox horns

From sight feed lubricator in cab.

Oil lubrication from oil boxes and keep.

... According to the recommendations of the roller bearing manufacturer.

... Hard grease.

... Soft grease lubrication.

Oil lubrication from oil boxes for the pur-

Soft grease lubrication.

Friction fabric liners are not to be lubricated.

#### LIX. Tanks and Bunkers.

Compensating beam pintles.

(Clause 72 of Standard Specification)

Drawing reference: E/SL 131/183-198.

E/ST 176/31.

Tanks and bunkers shall be provided for carrying a minimum of 4000 Imperial gallons of water and 6½ long tons of coal.

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Tanks and bunkers shall be of riveted construction. The tank bottom plate and partition plate between the coal and water shall be 5/16" thick.

The water shall be carried in the rear tank and the two side tanks. No belly tank is required. The general arrangement of the rear tank and side tanks shall follow the exhibited drawings with dimensions altered as necessary for the locomotive now required.

Provision shall be made for 4 water filling holes as in the drawings exhibited. Two of these shall be for the rear tank and one on each side tank. The side and rear tanks shall all be interconnected by suitable piping not less than 7" bore, so that water filled into any one tank will gravitate rapidly to the others.

Attention is drawn to the requirements of good visibility through the cab glass windows over the tanks.

It is desirable that the tops of the tanks be sloped as shown in CSL Drawing 2441, so that any water overflowing on the tops of the side tanks would drain off outwards rather than on to the axle boxes.

The tank water level gauge in the cab shall generally be of the design shown in drawing No. E/ST-176/31.

The rank water lord gange in the cab shall generally be of the design shown in Drawing E/S T-176/31.

#### LX. Strainers.

(Clause 73 of Standard Specification)

Drawing reference: E/SL 131/189, 190.

The strainer shall be of the design shown in the exhibited drawings. The material of the strainers shall be to IRS Specification M. 16 galvanised.

#### LXI. Tracings.

(Clause 90, 91 & 92 of Standard Specification)

Drawing reference: CSL Drawings 2000 & 2015.

The requirements of Clauses 90, 91 and 92 of the Standard Specification are to be strictly adhered to. The 'as made' tracings shall be indexed on the lines of E/SI, 131 Drawing Set and necessary changes indicated in CSL Drawing 2015 shall be incorporated. CSL Drawing 2000, which gives the sizes of sheet, general make-up, nomenclature of items, schedule of material particulars, machining symbol, etc., shall be followed.

The method of dimensioning and projection of end and plan views shall follow Drawing Set E/SL-131.

The engine will be designated as 'WH' class.

Particulars regarding the numbering of the drawing set will be advised separately.



## APPENDIX I

CSL Drawing 2441 shows the tentative outline of "WH" class Locomotive (Tank) Engine now required and is included for general guidance only.

This drawing is exhibited with other drawings listed in appendices II to V.

Drawing No.	Last Alt. No.	. Description	Relevant clause of Particular Specification.
CS1. 2441	1	Diagram of 2-8-4 type "WH" class Locomotive for shunting service.	Part C.



## APPENDIX II

"AS Made" drawing set E/SL-131 refers to Broad Gauge 2-6-4 type "WM" class locomotive (Tank) Engine and is exhibited as a guide to the general practice to be followed in the design of Locomotive (Tank) Engine now required.

"AS Made" Drg. No.	Descript <b>io</b> n.	Relevant Clause of Particular Specification.		
E/SL-131/1 to 236	2-6-4 type "WM" class Locomotive (Tank) Engines built against Contract No. RB/30WM/50 of 1950	Part C.		



## APPENDIX III.

"AS Made" drawings other than set E/SL-131 illustrative of Particular features to be embodied in the design of the locomotive tank engines now required in amplification or modification of the design shown on the exhibited drawing set E/SL-131.

1	Particular Specification.
(2)	(3)
Firebrick arch and tube arrangement.	XVI
Front & hind cylinder covers.	XXXIV
Slide bar.	XXXV
Front truck axle box arrangement.	LIV.
Front truck bearing spring.	•
Front truck transverse beam.	
Front truck compensating beam.	••
Front truck centre cover links & pins.	. • • • • • • • • • • • • • • • • • •
Frontitruck arrangement.	1
Front truck arrangement	,,
Front truck arrangement	,,
Swing link & safety chains.	
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선택적의 역약적	XXIII
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-	xxxiii
	XXXIII
1	XXXIII
	XLIII
-	xxxvi
	LIV
•	LIV
	LIV
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	XLIV
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	Firebrick arch and tube arrangement.  Front & hind cylinder covers.  Slide bar.  Front truck axle box arrangement.  Front truck bearing spring.  Front truck transverse beam.  Front truck compensating beam.  Front truck centre cover links & pins.  Front truck arrangement.  Front truck arrangement.  Front truck arrangement

E/SL-127/283	Sanding gear arrangement.	LI
284	Standing gear details.	LI
285	Standing gear details.	LI
286	Sand pipe stays.	LI
289	Steam brake cylinder.	riii —
E/SL-217/25	Boiler elevation hind end.	XVII
58	Grate arrangement elevation.	XXI
59	Grate arrangement plan views.	XXI
€o	Rocking grate firebars & side frames.	XXI
G1	Rocking grate operating details.	<b>XXI</b>
64	Hopper door arrangement.	XXII
65	Hopper door details.	XXII
E12703/18	Firebox arrangement elevation.	XIV & XXXI
19	Firebox arrangement end views.	XIV & XXXI
20	Foundation ring.	XIV & XVII
21	Expansion angle.	XIV
143	Eccentric rod.	XLI
6 WG 88	Piston rod packing.	XXXIV
100	Piston valve spindle.	XL
108	Front truck wheel.	LIV
E 12885	Standard flexible roof of water space stays	XIX
E 11673/53	Firebox back arrangement.	XXIX
56	Injector steam valve & details.	XXIX
E/ST-176/31	Water gauge & Tank cock.	LIX
	# E3 EM #	

#### APPENDIX IV.

Central Standards Office drawings of series CSL, I.R. Part and C.S.O.L. Sketches, illustrative of particular features to be embodied in the design of locomotive now required in modification of the design in the exhibited drawings listed in appendices II & III.

Drawing No	Last Alt. No.	Clause No.	Referenced in Draw- ing No.	Description.
(1)	(2)	(3)	(4)	(6)
CSL 214		XXXI	•••	Washout & filling plug.
1582	3	XXXI		Location of Inspection, mud doors, washout plugs & man- hole.
1694	1	XXXVIII		Cast steel crosshead.
1798		LIV		Lubrication arrangement for front truck axlebox swing links
1936	3	xxII		Locking clamp for damper door lever.
1984	1	xxxi		Provisi n of additional steam cock between "Detroit" lubricator & Steam stand.
2000	3	LXI		Location of standard tables & Particulars of stamping "as made" drawing set engine.
,2015		LXI		Typical index sheet for "as made" drawing set engine.
2056	2	XLVII	<i></i>	Details of coupled axle box channel lubrication.
2145		XLIII		Hub liners in halves for coupled wheels.
2162	1	xxIII	6	Ring type hinge for smokebox self cleaning flap plates.
2164	2	XLVII		Frame pedestal shoes, wedges & liners.
2184		LIV	. "]	(Bul)
2185		LIV		157.737
2186		LIV		Arrangement & details of gravity & Spring controlled front truck.
2187		LIV		www.and
2188		LIV	J	सन्धम्ब जयत
2227	2	VIXXX	•••	Combined cylinder liner plag & lubricating connection.
2241		XIII	)	Flanged manhole seating.
2318		XLIII	***	Modification to driving wheel centre for application of crank pin hub Liner.
2355		XLVII		Modification to frame clip & horn stay.
2428		XLVII		Oil lubricated composite coupled axle box.
2429		XLVII		Oil lubricated composite coupled anle box.
2430		XLVII		Arrangement of coupled axle box lubrication.
-CSO. Sk. L-353		XI & XX		Layout of boiler flues & tubes.
LA/AB-15	7 1	XLVII	1	Coupled axle box assemblies.
158	3 1	NLVII		anner have deservened as

REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE,

(1)	(2)	(3)	(4)	(5)	
L/AB-638	)				:
639					
640	!				
642	1 !				
643	2		\		
644	1	XLVII	LA/AB-157 & or LA/AB-158	Coupled axlebox components.	
645					
646					
647					
648					
649					
641	J				
L/CL-615	1	XXXIV	***	Hind steam chest cover,	
L/CL-616	1	XXXIV	•••	Front steam chest cover.	
L/MN-611	1	XLI		Radius rod die block.	
L/MN-621	1	XLV	•••	Eccentric crank.	
L/OC-618		XLVII	LA/AB-157 & LA/AB-158	DEROPE DE	
L/PV-601	1	XXXIX		Piston valve head.	
606	1	XL		Valve spindle crosshead.	
L/PX-601	`	XXXVII		Piston rod.	
L/SC-14	l .	XLVII	LA/AB-157	1 3 N A	
			LA/AB-158		

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### APPENDIX V

Central Standards Office drawings of series C.S.L., L.S.C. & I.R. Part drawings in series C,L,V,B,W & T.A. illustrative of standardised dimensions and fittings to which the design of the locomotive engines now required must comply and from which the fittings included in the design must as far as possible be selected.

Drawing No.	Last Alt. No	Clause No.	Referenced in Drawing No.	Description
1	2	3	4	5
LSC-19	1	X & LT	•••	Diagram showing infringements to maximum moving dimensions.
CSL-234	3	xvı		Standard Bricks.
CSL-1680	1	LVIII		Governing dimensions for hard & soft grease nipples.
1718	. 3	XXVIII		Top feed clack box.
1720	2	LVII		Cone joint connections for copper pipes.
1926	2	XLV	•••	Leading crank pin.
2064		XXXIII		Screw coupling hook.
2161	3	XXIII&LV	0	Standard Engine & Tender buffer lamp.
2163	1	1XXX	(E)	Modified whistle connection.
2252	1	LIV		Wheel for hind bogie.
I.R. Part Drgs			6	
LA/BD-153		LII		Loco side buffer assembly.
L/BD-648	۱ ر		(6)	7(0-1/2)
649	]		ALC:	
650				त्यमेव जयते
651				
652			ĺ	
653		Lit	LA/BD-155	Loco side buffers com onents
654	}			
655				
656				
657				
658				
659	j			
LA/BM-151	1)			
L/BM-601	}			
602	1			
603	}	xxxı	•••	Gauge glass protector assembly & components
604	1			
605	,			
607	j			
T./BM-608	4	xxxt		Fusible plug.
609	,	x xı		Weshout plug.

# APPENDIX V (Contd.)

1	2	3	4	5
LA/BV-152				
L/BM-6.5				 
626	]			
627	!			
628	}	xxxi	• • •	Gauge column blow through cock assembly & components.
629				
630	1,			
631				
632	}			
933	1	IXXX	,,,	Arch tube plug.
LA/BM-155	<b>)</b> .	XXVIII &		·
		1 9		
160		XXVIII & XXXI	***	
161				 
162				
L/BM-612	!			
614			É	
615			1	
616	}		· V	
617				A TO A TO
618		}	6	12.1 ED -
210	ļ		6	Q( c = (2)
619	··· }	XXXVIII		1", 3", 5/8", ½" Globe valves (Male) assemblies & components.
620 621	"	& XXXVIII & XXXI		सत्यमेव जयत
<b>622</b> 649				
650				
651		:		
652	-		: 	
653				·
654				
655				1
659				
660		1	1	
661				
LA/BM-183				
L/PM-770			!	
771	}	xxxi	xxx	Ejector steam cock assembly & components.
772	[			, to tomponents.
773	}		1	

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REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE
APPENDIX V (Contd.)

·			1	1 (contact)
1	2	3	4	5
LA/12R-151	)			
152				
169				
171				
172				
L/BR-602	}			
604	}			
613	{			Inspection & mud doors assemblies & components.
614	}	XXXI	•••	inspection & mild doors assemblies & components.
615				
616	{			
617				
707				
708		1		
760				
761	j			
L/BR-683	•••	XIII		Cover for manhole seating.
L/BT-11	•••	XLII	LA/CR-153	Bolt 1" Dia. x 7 11/16" Long.
LA/CL-151	***	XXXIX		
152	•••	XXXIX		
L/CL-604	j		N	
605				YA ITU U
606	]			Cylinder relief valves assemblies & components.
607	}	XXXIX	LA/CL-151	
608	1		LA/CL-152	
609				सत्यमेव जयत
610	ا ل			
LA/CL-153	1	XXXIV		
L/CL-601	1	-,	LA/CL 153	Cylinder drain cock assemblies & components.
602	2		· · · · · · [	,
603	3		1 ,	
LA/CL-154	1	XXXIX	\	
L/CL-617	)			
618				
619	ا الم	XXXIX	LA/CL-154	Bye pass valve (N.C. type) assembly & components.
626	1			
627	··· [ ]			
628	J			
L/CL-728	2	XXXIV	•••	Cylinder front cover.
729	2	XXXIV	•••	Lagging plate for cylinder front covor.
LA/CR-152	2	XLII	•••	Coupling rods assembly.
153	1	XLII		Connecting rod assembly.
154	2}	***		
155				

# REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE APPENDIX V (Contd.)

1	2	3.	4	5
156	<u>)</u>	P. S. 1. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
J/CR-408	i	}		•
604	1		Ì	
605				
606			·	
607	1			•
608		l		
610	2			•
61 <b>2</b>	2			
613	1			
614	1			
616	1	XLII	LA/CR-152	Connecting & coupling rods minor assemblies components.
617	1		LA/CR-153	
618	1			
619	1			
620	1			
621	1		2	weeks and the second
622	1		6	
623	1		, and the second	
625			1	
626	1 1			701 Y SA ?
627			1	
628	1 1		- 1	
633	)			renia anà
634	2	T 477		Assemblies & Handle assemblies.
LAJEQ-151	2	LVI	***	Assemblica & Francis Casamaria.
152	1	LVI		·
LA/GL-151	1	ļ		
15 <b>2</b> 154				
155		Í		
L/GL-601				
602		ĺ		
604				
605	}	LVIII		Hard & soft grease nipples assemblies & components.
606				
607				
608				
609		}	1	
610		-	Í	
611	l j			
L/GL 302	2	XXXVIII		Adaptor, grease nipple (gudgeon pin).

# REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE. APPENDIX V (Contd.)

1	2	3	4	5
L/IR-616	j		Ì	
617				
618				
619				
658	- '			·
659	· i			
6 <b>6</b> 0	1			
661	}	XXVIII		9m/m Injector components.
662	··· j			
663	··· j			
664				
665	} }		·	
666	•••			
667				- TO 10
668	[		6	
669	٠ ا		9	
L/KY-17	1	XLII	LA/CR-153	Key 7/16" T.H. x 9/16" width x 4½" Long.
18		XLII	LA/CR-152	TURNON
39	•••	XLII	LA/CR-152	Key woodruff, 1" dia. x 5/16" TH.
47	***	XXXVIII	•••	Gudgeon pin key (woodruff) 1 dia. x f' Th.
60	1	XLV	(SL 1926	Dowel & dia. x ½ Long.
65	•••	XLII	LA/CR-153	Dowe! * Dia. x 1 * Long
L/ML-607		XXX	LA/SX-153	Joint ring for Anti Vacum valve.
L/NT-11	1	XLII	LA/CR-153	Nut I" Dia B S.W. x #" Ht.
30	1	XLII	LA/CR-152	Nut2 4" dia. x 6 T.P.I. x 14" Ht.
31	1	XLII	LA/CR-153	Nut 13" dia. x 6 T.P.I. x 13" Ht.
58	•••	IIIVXXX		Nut 2‡" Dia. x 8 T.P I. x 1‡" Ht. (Gudg-on pin).
128		XXX	LA/SX-153	Nut & B.S W. (Type B) F/S. Hex. & Height.
129	•••	XXXI	LA/BR-151 & 169	Nut ‡" B.S.W. (Type B) F/S. Hex & Height.
130	•••	XXXI	LA/BR-171	Nut 1" B.S.W. (Type B) U/S. Hex & Height.
148		XXX	LA/SX-153	Nut ?" B.S W. (Type B) U/S. Hex & Height.
205		XXXIX	LA/CL-154	Nut 1/2" B.S.W. F/S. Hex & Height.
207		XXXVIII	LA/CL 154	Nut §" B.S.W. 13/16 Height.
28)		XXXVIII		Nut ) ‡" B.S.F. for crosshead connection.
281	••	XXXIX		Nut 11" B.S F. (Type B) for crossheah connection.
LA <sub>1</sub> OC-151	j	; 		· 
152				
153	}	LVIII		Oil boxes & oil cups assemblies.
154	;	LAIII		On DOXOS of On Cups assentones.
155	Ì			

# 

1	2	3	4	5
L OC-601	<b>٦</b>			
602	]			
603			į	
604				
605	≻	LVIII	•••	Oil boxes & oil cups components.
606	[	'		
607				
608				
609				
610	ر			
LA/PC-55	]			
56	··· į			
57	··· }	LVII	•••	Pipe unions.
58				
59	ر			
L/PV 607	•••	XL		Piston valve spindle cotter.
L/PX-314	4	& XLII	LA/CR-152	Gudgeon pin locking plate knuckel pin plug.
L/PX-605	J		9	Gudgeon pin locking plate
606				Gudgron pin cone bush
607	1	W-W-W-T7.77		Crosshead side liner.
608	۲	XXXVIII		Crosshead pressure plate.
609	1 '	ļ 	- {	Gudgeon pin.
611	ر			Crosshead split sleeve
5./1°X-622		XXXVI		Piston head ball bearing
625	•••	xxxvii		Piston Head
1./SU-11	•••	xxx	LA/SX-153	Stud (Type A) 3" Dia. x 32" Long,
24	1	XXXIX	L \/CL-154	Stud (Type B) 1/2" B \(\cdot \).W. x 1%" Long.
25	1	XXXXX	LA/CL-154	Stud Type B) § B.S.W x 1½ Long.
69		IIIVXXX	•••	Stud for crosshead connection.
LA/SX-153	•••	xxx	•••	Anti vacuum value assembly
L/SX-604	<b></b> }			
605				1
606		-	Į.	
607	}	XXX	LA/8X- 53	Auti Vacuum valve components.
608	·			
622				
673	ر	:		
L/TY 608	•••	XLVI	]	Coupled wheel tyres for B. G. Locos.
609	•••	XLVI	- J	],
624		XLVI & LIV	}	Carrying wheel tyres for B. G. Loco.
625	•••	XLVI & LIV		1

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REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE
APPENDIX V (Contd.)

	,	<del>,</del>		MA V (Contd.)		
1 _	2	3	4	5		
L/WL-602	<b>)</b>		CSL-1926	Leading crank pin collar.		
603			CSL-1926	Leading crank pin bolt.		
608	1 (	*****		Leading crank pin collar.		
609	1	XLV		Driving crank pin,		
636	j		CSL-1926	Leading crank pin.		
637	J			Trailing crank pin.		
I.R. PART C-1642	1	LV		Dubber Burner.		
TA-5062	7	X & LIV		1 in 8½ feet turnout & 15'-6" over riding switch.		
VBA·80		LIII	<b>)</b>	Reducing T connection to gauge assembly & components.		
VB-180	1	LIII	)	Reducing I connection to gauge assembly & components.		
VBA-84	•••	LIII	}			
VB-184	2	,,	ĺ	Drip trap and valve assembly & components.		
185		,,	<u> </u>	Drip trap and valve assembly & components.		
186	•••		}			
VBA-95		rm	٦ ا			
<b>VB-4</b> 06	•	]				
<b>95</b> 0	2		}	Ball coupling assembly & components.		
951	1					
952			j@			
VB-211	•••	XXXI, LIII		Duplex vacuum gauge.		
316	1	LIII		Reducing syphon 2 way 2" x 2".		
318	4	,,		Swan neck.		
321	6	,,		Universal coupling 2°.		
322	4	.,	1	Dummy coupling 2'.		
401	5	. ,,		Hose pipe clip 2".		
402	5	,,		Hose pipe clip 2"		
403	5	١,,	}	Hose pipe clip 1/2".		
404	3		1	Cage for 2" vacuum hose pipe.		
405	•••	,,		Coupling washer 2",		
407	4	.,		Hose pipe 2".		
500	1			Hose pipe Inter 18" x 2".		
<b>5</b> 01	•••	,,		Hose pipe Inter chamber 18" x 1".		
502	1	,,		Hose pipe syphon $24'' \times \frac{3}{4}'' 1/2''$ .		
503	. 1	,,	j	Hose pipe syphon 18" $x_4^2$ " 1/2".		
504	2			Hose pipe 27" x 2".		
506	2			Hose pipe syphon 24" x ¾" x ¾".		
"WA/I	6	LII		Screw coupling assembly.		
WA-436 W-428 429 431 432 433 434 435 437	1 7 5 6 3 3 8 8	<b></b>	WA-1 Screw coupling & components.			

### APPENDIX V (Contd.)

1	2	3	4	5
W-438 439 440 441 442	5 3 2 3 2			Screw coupling assembly & components.

In the "As made" tracings Indian Railways standard Part drawings in series C, L, VB, W & Y are not to be redrawn in detail. Where such parts appear in arragement drawings, they are to be shown in outline and the I. R. Part drawing number with alteration number to which the part is made shall be indicated in the arrangement drawings.



## APPENDIX VI

Latest revisions of Indian Railways Standard Specifications.

I. R. Specification	Year of Last Revision.	Addendum or Corrigendum slip if any issued.
1	2	3
A 3	1951	
E 9	19:3	
Н 5	1951	
H 6	1954	
н 7	1951	
11.8	1950	
H 19	1949	·
H 20	1952	
H 21	1947	
м 1	1953	
M 2	1948	
м з	1949	Corrigendum No. 1 of March 1954.
M 4	1949	
М 5	1954	
м 6	1952	
М 7	1947	
м 8	1945	10.0
м 9	1953	721.3 84.8
M 11	1953	
м 16	1949	Referenced in Clause LX of this Particular Specification
M 21	1948	सत्यमेव जयते
м 22	1950	वाजनान नानव
м 24	1953	
M 25	1949	
M 26	1953	1
N 6	1939	
N 10	1954	
N 17	1949	
N 20	1950	
N 21	1953	
RI	1954	
R 2 *	1955	
R 3	1953	
R 8	1954	
R 9	1953	
R 11	1941	
· R 13	1954	
R 14	1947	
R 15	1951	· · · · · · · · · · · · · · · · · · ·

# REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE APPENDIX VI (Contd.)

1	2	3	
R 18	1953		
R 20	1950		
R 21	1942		
R 22	1954		
R 23	1951		
R 25	1939		
R 26	1953		
R 27	1950		
R 29	1950		
R 32	1954		
<b>W</b> 1	1949		
W 3	1953		
Y 2	1949		
Z 1	1947		
Z 3	1949		
z 6	1951		
I.R.S. Limits & Fits to be used for Loco- motive works.	Nov' 1950	Page 20 Alteration 1.	



## APPENDIX VII

Latest revisions of British Standard Specifications and Director General of Supplies & Disposals Standard Specifications.

D	C .	Charitications	
ю.		Specifications	
	~ .		

B. S. Specification No.	Year of last Revision.	Addendum or Corrigendum Slips, if any issued.
	2	3
7	1953	PD 1782 December 1953.
10 Part I	1947	Amendment PD 1157 March 1951.
10 Part 2	1926	Amendment PD June 1927.
10 Part 3	1929	Amendment CC 3901 April 1931.
10 Part 4	1931	
10 Part 5	1932	
18	1950	Amendment PD 1093 September 1950
21	1938	
28	1932	See Clause LVII of this Particular Specification.
31	1940	Amendment of 9846 March 1942.
46 Part 1	1953	
46 Part 2	1929	Cancelled and superseded by B.S.S. 2059.
46 Part 3	1951	
52	1952	
161	1924	War time issue 1941.
190	1925	See Clause LVII of this Particular Specification.
240 Part 1	1937	T. S. C.
240 Part 2	1950	
334	1934	Memorandum CG 349 May 1942.
916	1953	Amendment PD 1894 May 1954.
1083	1951	
2059	1953	Supersedes B.S.S. 46 Part 2.

### D. G. S. & D. Specifications.

D. G. S. & D. Specifications	Year of Last Revision	Addendum or Corrigendum Slips if any issued.
G/Misc: 86/C	1951	

## APPENDIX VIII

List of spares to be supplied against the whole set of 34 "WH" class Locomotives

1.	Roller bearings for Pony truck excluding cannon axle box.	8 Nos.
	Roller bearings for hind bogie excluding axle boxes.	8 Nos.
3.	Eccentric rod roller bearings.	4 Nos.
4.	Cast steel coupled axlebox complete with bearings.	1 Engine set.
5.	Bronze bearings with white metal lining for coupled axle boxes.	Two Engine set (4 Ldg., 4-
6.	Coupled axle box keeps.	Int. 4 Org. & 4 Trg. Two Engine set (4 Ldg., 4
7.	Ecceutric rod (without roller bearing).	lnt 4 Drg. & 4 Trg. 4 Nos.
8.	Front truck control spring.	Four Engine sets
9.	Hind bogie control spring.	Four Engine sets.
10.	Element tubes.	Two Engine sets.
11.	Firebars and carriers wooden (patterns only).	One set.



#### APPENDIX IX.

#### LIST OF PERMISSIBLE ALTERNATIVES

Items not included in this list shall be either in accordance with the exhibited drawings or as specified in this Particular Specification.

Description '	Permissible Alternatives				
Material for water space stays.	(1) Steel to I.R.S. Specification M7 Class VI.				
	(2) Longstrand steel.				
	(3) Dunic steel.				
	(4) Stabol (Novo steel).				
	(5) Titanic (Samuel Osborn).				
	(6) Stag super fibro stay bolt steel (Edgar Allen).				
Blow off coc'.	(1) "Evrit"				
	(2) "Everlasting".				
Ejector	(1) Sq. 'G' R. H. (2) Davies & Metcalfe 'M' type R.H.  fitted with G&C graduable steam breake valve.				
Hydrostatic lubricator	(1) Wakefield AC type 4 feed, 5 pints capacity.				
	(2) Detroit 5 feed, 5 pints capacity with additional at location I. R. Globe pattern valve fitted shown on CSL Drawing 1984.				
Piston rod packing	(1) Britallic.				
443	(2) Paxton Mitchell.				
177.50					
Roller bearing axle boxes.	(1) Skefko				
स्वम	(2) Timken				
	(3) Hoffmann *				
Roller bearing on Eccentric crank.	(1) Skefko				
·	(2) Timken.				
Fabric material for hind bogic pivot liners.	(!) Ferobestos or Ferobestos L				
	(2) Salvebestos LP 3 or CMZ				
	(3) Mintex ZS or H4.				
	(4) Railko AL2.				

<sup>\*</sup> The number of Locomotives which shall be fitted with "Hoffmann" roller bearing axle boxes manufactured outside India shall not exceed 20 percent of the total quantity on order.

APPENDIX - IV (To Item No. 40.)

GOVERNMENT OF INDIA MINISTRY OF RAILWAYS

# INDIAN RAILWAYS SCHEDULE AND PARTICULAR SPECIFICATION. NO. L-10 OE 1955

FOR

STEAM LOCOMOTIVE AND TENDER

2'-6" Gauge

2-8-2 Туре

WITH SIX WHEELED TENDER.

121 किए एउट किए स्थामन जयने

Central Standards Office For Railways (Railway Board)
CHITTARNJAN
(Dist. Burdwan) India.

September, 1955

# INDIAN RAILWAYS

:'--6" Gauge

# SCHEDULE

Item No.	Quantity required.	Description.
1.		LOCOMOTIVE ENGINES, 2'-6" gauge, 2-8-2 type, with six wheeled tendered having coal capacity of 4 long tons and water capacity of 1700 Imperial Gallons; maximum axleload 7.0 tons fitted with Superheater, Walscherts Valve gear & piston valves; the whole to be in accordance with:
		(a) the attached Particular Specification No. L-10 of 1955;
		(b) Indian Railways Standard Specification for Steam Locomotive Engines and Tenders, Serial No. R 32 54; and
		(c) the conditions of Contract issued by the Director General, India Store Department, London, or Railway Board, New Delhi, India.
2.	One set of handmade tracings and two sets of reprintable mechnical copies, in tracing linen.	Complete set comrising of the following:—  (a) Tracings of Index Sheets.  (b) Photographic views,  (c) Tracings of drawings of the locomotives  "As Made" according to item 1 above and as specified in Clause XLI of the Particular, Specification No, L-10 of 1955.
3		Spare parts as listed in Appendix 1X of the Particular Specification No. L-10 of 1955.

The Standard Specification R. 32-54 calls for Acid Open Hearth steel for boilers, axles and tyres Basic Open Hearth steel produced under stringent metallurgical control will be accepted in lieu. The firms tendering must state clearly whether they will use Acid Open Hearth or Basic Open Hearth steels for these parts and must also state below the amounts by which their tenders will be increased or decreased for supplying the alternative qualities of steel.

	Boilers	Acid Open Basic Open							
	Axles	Acid Open Basic Open	Hearth St Hearth St	teel teel		***********		********	•••••
•	Tyres	Acid Open Basic Open	Hearth St Hearth St	teel teel			************	···	•••••
vith an	ny part of specifically	hip and Meteria the requirement what variation or will be held s	nts of the therefron	particula n is cove	ar or Sta cred by th	indard S ie tender	pecificatio and wher	n. it mus e not so r	t be
,	The tender	er shall furnish	the follow	ving inform	nation :-	_			
,	The steel	boiler plates	will be n	nade by	• • • • • • • • • • • • •	•••••••	***********	***********	
		inside firebox							
			5	15 2 S	23	*			
		tubes will be	, i						
	The boiler	tubes and sup	erheater :	flue tubes	will be a	nade by.			*****
	The super	heater element	ts will n	nade by	· • • • • • • • • • • • • • • • • • • •		*********		*****
******	The rigid	water space	stays wil	l be ma	de by	**********	**********		
	The axles	s will be mad	le by		······································		······································		
	The tyres	s will be mad	le by		·····		•••••••		*****
	The whee	el centres will	be made	e by	**********	• • • • • • • • • • • • • • • • • • • •	**********	•	
			**********	**********			**********	* 71570 * * * * * * * * *	•••••

	ame plates will be made by
The cy	ylinders will by made by
The sr	nokebox sadles will be made by
The ge	eneral steel castings will be made by
The loc	comotives will be built at



#### INDIAN RAILWAYS

#### PARTICULAR SPECIFICATION NO. L-10 OF 1955

#### FOR

#### STEAM LOCOMOTIVE ENGINES & TENDERS

2'-6" GAUGE 2-8-2 TYPE

#### WITH SIX WHEELED TENDER

#### MAXIMUM AXLELOAD -7.00 TONS.

- I. The locomotive engines and tenders required are described in the Schedule accompanying the tender documents and illustrated in CSL Drg. 2445 appended to this Specification. The Locomotives are to be built in accordance with the Standard Specification for Steam Locomotive Engines and Tenders Rs. 32-54 so for as it is applicable and with the requirements of this Particulars Specification.
- II. This Particular Specification is arranged in four parts as follows:-
  - PART A. Relating to the drawings pertinent to this Particular Specification.
  - PART B. Relating to modifications required to the Standard Specification applicable to all types of engines and tenders built in future; also embracing testing packing, drawings and other general requirements.
  - PART C. Relating to detailed engine design requirements in amplification of the provisions of the Standard Specification and in modification or explanation of the exhibited drawings applicable to the locomotive engines now required.
  - PART D. Relating to detailed tender design requirements in amplification of the provisions of the Standard Specification and in modification or explanation of the exhibited drawings.
- III. The clauses of this Particular Specification are numbered in Roman numerals. The number of the clause or clauses of the Standard Specification to waich each clause of this Particular Specification relates is shown in Arabic numerals below the serial number. The clause in this Particular Specification either amplify or modify the requirements of the Standard Specification and/or the exhibited drawings.
- IV. Should it be found that this Particular Specification does not clearly indicate the applicability or otherwise of any individual requirement of the Standard Specification to the locomotive engines and tenders now required, or should there be any points of difference between the Standard Specification and the exhibited drawings not provided for in this Particular Specification, the Contractor must submit each item to the Director General, India Store Department, London, or the Central Standards Office for Railways, Chittaranjan for instructions.
- V. Copies of the Indian Government Railway Standard Specification for Steam Locomotive Engines and Tenders, No. R. 32-54 may be obtained on payment from the Office of the High Commissioner for India Publications, Branch, India House, Aldwych, London, W. C. 2 or the Manager of Publication, Civil Lines, Delhi-8 (India).

#### PART A.

# Relating to the drawings pertinent to this Particular Specification.

VI. The drawings exhibited are listed in the appendices to this Particular Specification classified as follows:-

APPENDIX I. CSL Drawing No. 2445 Alt. illustrative outline of 2-8-2 type locomotive and tender now required and is given for general guidance only.

APPENDIX II. "As Made" drawing sets E/SL-304, 1 ZPT and selected drawings from 1YL set. These drawings are exhibited as a guide to the practice to be followed generally, as modified by the requirements of this Particular Specification.

APPENDIX III. "As Made" drawings, other than quoted in Appendix II illustrative of particular features to be embodied in the design of the locomotive engines and tenders now required in amplification or modification of the design shown on the exhibited drawings listed in Appendix II.

APPENDIX IV. Central Standards Office for Railways drawings of series CSL, LSC, or I. R. Part Drawings illustrative of Par icular features to be embodied in the design of the locomotive engines and tenders now required in modification of the designs in the exhibited drawings listed in Appendices II and III.

APPENDIX V. Central Standards Office for Railways drawings of series CSL, Sketches, and Indian Railway Standard Part drawings of series C.L or VB illustrative of a range of standardised dimensions and fittings to which the design of the locomotive engines and tenders now required must comply and from which the fittings included in the design must as far as possible be selected. Attention is drawn to the foot-note at the end of Appendix V, regarding I. R. S. Part Drawings not to be re-trace i for inclusion in "As Made" sets.

The drawings will be placed on view at the Offices of the Director-General, India Store Department. London, and at the Central Standards Office for Railways, Chittaranjan. Copies of drawings may be obtained on payment by firms tendering for the work from the above source on production of this Particular Specification.

The drawings provided for the use of the Contractor are not guaranteed to be free from discrepancies, etc., and they must be modified in whatever points are stated in the Particular and Standard Specifications, or may subsequently be desired by the Director-General, India Store Department, London, or the Central Standards Office for Railways, Chittranjan without claim by the Contractor for extension of time or increase of price, except as provided for under the Conditions of Contract.

The Contractor whose tender is accepted must provide himself at his own expense with copies of the drawings exhibited, which copies can be used instead of the originals by the Contractor in preparing his working drawings.

Tenders are warned that, from time to time, modifications are made in the drawings, and they must, therefore, satisfy themselves that any copies of the drawings quoted (which they have had previously) show all the latest modifications made to date.

The Contractor must prepare, before the work is commenced, at his own cost from these drawings, from the Particular and Standard Specifications, and from the instructions of the Director-General, India Store Department, London, or Central Standards Office for Railways, Chittaranjan, a complete set of working drawings, which are to be in every respect as shall be approved by them.

Reference is also invited to Clause 90 of the Standard Specification R. 32-54.

#### PART B.

# Relating to modifications required to the Standard Specification General Regirements,

VII. Sublet orders for materials. Complete instructions as to submission of proposed Sub-Contractors, names for approval and furnishing copies of sublet orders may be obtained from the Director-General, India Store Department London, or Central Standards Office for Railways, Chittaranjan, on application.

Electric Arc Welding. Reference Clause 3 of the Standard Specification, electric arc welding must comply with a "Code of Practice" approved by the Inspecting Officer.

The Railway Initial Letters for the marking of parts in compliance with Clauses 6 and 86 of the Standard Specification shall be "I R."

Painting and marking:—The Locomotives shall be delivered, finished painted black and varnished. Particulars regarding marking, and numbring of the locomotive engines, will be supplied later.

Shipment: - Details will be specified after Contract is let.

Tracings:—One set of hand-made tracings and two sets of mechanical copies in tracing linen shall be supplied, for use in India not later than the delivery of the first locomotive under this Contract.

VIII. Materials:—The latest revisions of I. R. S. & I. S. I. Specifications are indicated in Appendix VI.

The latest revisions of relevant British Standard and Directorate General of Supplies and Disposals Specifications are indicated in Appendix VII.

A list of permissible alternatives is given in Appendix VIII.

IX. Spares:—Spare part requirements are listed in Appendix IX. These shall be supplied not later than the last locomotive delivered under this Contract.

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#### PART C

#### Detailed Engine Design Requirements.

The locomotive engines are to follow the Standard Specification R. 32-54 except where Departures are called for in this Particular Specification. CSL Drawing No. 2445 alt. 1 shows a tentative outline diagram of 2-8-2 type locomotive now required. Dimensions and proportions indicated in this drawing are desired, but departures may be found necessary to suit design requirements. None of the features described hereunder shall be deemed as final pending approval of drawings.

The locomotive is required primarily for goods service hauling loads up to 400 tons at a minimum speed of 10 M. P. H. on ruling gradients of 1 in 100.

It is emphasized that increase on the specified maximum axleload is not permissible, and firms tendering must, therefore, satisfy themselves that the specified axleloads can be adhered to without alteration to the basic design required.

Attention is drawn to Clause 8 of the Standard Specification regarding the strength of the boiler and its details.

In the clauses below, the term "leading coupled axle" will refer to the coupled axle immediately behind the main steam cylinders. "The trailing coupled axle" will refer to the coupled axle nearest the cap. The "front truck" is the pony truck ahead of the leading coupled axle and the "hind truck" is the radial truck immediately behind the trailing coupled axle. "The Driving axle" shall be the third coupled axle as shown in CSL Drawing No. 2445, that is, the coupled axle adjacent to the trailing coupled axle. The remaining coupled axle between the driving and leading coupled axles will be refered to as "inter-coupled axle".

In the exhibited drawing sets, the materials quoted against certain components do not conform with-the specifications to which the materials should comply according to the requirements of IRS Specification R. 32-54. The deviations should be brought to the notice of the Inspecting Officer and unless decided by him to the contrary, the IRS Specification R. 32-54 should be observed.

The following clauses indicate the principal requirements in the design of the locomotive engines now required.

# X. General requirements and dimensions

(Clause 1 of Standard Specification).

Drawing reference

CSL Drawing 2445 Alt. 1

Maximum moving dimensions

To Indian Railways Schedule of maximum.

Minimum and Recomended Diamensions, 2'-6

Gauge, 1922, as amended to date and to R. P.

T'S Sketch No. 602.

Overall height from rail level

... Not to exceed 10'-6" with locomotive empty.

Clearance from rail

Clearance above rail level of these engines when tyres are new is to be not less than 4½ to allow for wear.

Axleload

Maximum permissible axleload 7.00 tons for all axles. Minimum axleload on front truck axle not less than 5 tons.

Gauge

2'-6".

Sharpest curve

191 feet radius with 3/8' maximum gauge widening.

#### ENGINE.

Wheel arrangement

2-8-2

Horizontal distance between centres of front truck axle and leading coupled axle.

... 5'-8\*

Horizontal distance between ceutres of leading coupled and inter coupled axles.

... 3'-2"

Horizontal distance between centres of inter-coupled axle and driving axle.

3'-2"

Horizontal distance between centres of driving and trailing coupled axles.

3'-2\*

Horizontal distance between centres of trailing coupled axle and hind truck axle.

7'-2"

Coupled wheels diameter on tread.

2'-10"

Engine front truck wheels diameter on tread.

2'-0"

Engine trailing truck wheels diameter on tread.

2'-3"

\_\_\_\_\_

. 4-0"

Cylinders

. Two Nos.—Outside.

Length of piston stroke

.. 18"

Cylinder bore.

14"

Height & inclination of cylinder.

Longitudinal cylinder centreline shall be horizontal and shall be in the plane of the coupled axle centres.

Lateral spacing of cylinder centre lines.

... 5'-101".

Steam Ports

1.3/8° wide.

#### XI. Boiler-General Design.

(Clause 8 of Standard Specification).

Drawing reference: 1YL-13 to 93, 182 & 193.

1ZP-30 to 34 & 106.

E/SL-217/25.

CSL Drgs. No. 2411, 1950, 2365, 2162, 1718, 2163.

IR Part Drgs. LA/BR-151, 169 & 171.

LA/IR-156.

The boilers of 2-8-2 type locomotives now required shall be of the design fitted to YL Class locomotives, and shall be built in accordance with Central Standards Office for Railways' drawings 1 YL-13 to 93, 182 and 193 incorporating the modifications and special requirements detailed below:

#### BOILER.

- 1. The firebox crown plate shall be lowered by 1.3/8", causing a corresponding reduction in the depth of the firebox. The boiler ratios, such as, heating surface, free gas areas etc., will require revision in consequence.
- 2. With the lowering of the firebox crown, the firebox tube and back plates shall be re-designed. The radius of the flange shall be made 14" in lieu of 1", increasing the width of the plates by ½" for this purpose.
- 3. The layout of flue and smoke tubes shall be rearranged preferably on the vertical diamond pattern, incorporating the original number of tubes, if practicable.
- 4. The water gauge column shall be lowered by 2.3/8 giving a depth of water of  $2\frac{1}{2}$  minimum against the highest part of the firebox crown when the engine is standing on level track with the water in line with the top of the gland nut of the bottom gauge column cock.
- A perforated plate shall be fitted inside the dome as shown in CSL Drawing 2411.
- 6. The gusset stay at the smokebox tube plate end and the cross-stay adjoining the outer firebox back plate and sides, shall be re located to be in the centre of the unsupported area. The waterspace stays shall also be rearranged to suit the new design of firebox and revised location of the bottom gauge column cock.

- 7. The brick arch tubes shall be lowered vertically  $1\frac{1}{2}$  at the throat plate end and  $1\frac{3}{4}$  at the back plate end. The brick arch shall be lengthened by the addition of one more brick.
- 8. Washout plug seatings for the brick arch tubes shall be lowered to suit the modification in item 7 above.
- 9. Relevant drawings prepared in compliance with the preceding requirements shall be submitted for approval.
- 10. All studs that are screwed into the boiler plate and seating shall be threaded 11 threads per inch Whitworth, and threaded portion for the nut shall be BSW.
- 11. Strengthening ring around manhole opening shall be fitted on the lines of the design shown in CSL Drawing 1950.
- 12. The firebox inner back plate at the firehole shall be flanged outward to meet the outer firebox back plate without a joggle on the lines shown in Drawing E/SL-217/25, and the firehole protector plate shall be modified to suit.
- 13. The firebox inner back plate shall be 13/32" thick.
- 14. Flat-faced inspection and mud doors in conjunction with circular seats as shown in IR Part Drawing LA BR-171 & 169 shall be provided on the curved surface of boiler and firebox at the locations shown in Drawing 1 YL-13. The compensating patches for the inspection door holes shown in Drawing 1YL-13 are not required with this modification.

Where mud doors occur on flat surfaces of the throat and back plates of the firebox, the circular seats are not required, but flat-faced mud doors shall be fitted, the elliptical opening being enlarged to  $3.5/32^{\circ} \times 2.13/32^{\circ}$ . The mud door shall be in accordance with I. R. Part Drawing LA/BR-151.

- 15. The foundation ring shall be in accordance with CSL Drawing 2365 in lieu of the design shown in Drawing 1YL-24. The hind breathing plate shall be generally to Ref: lett: P of drawing 1ZP-166.
- 16. The ashpan and ashpan drench pipe arrangement shall be to drawings 1 ZP-30 to 34.

#### smokebox:

- 17. The smokebox shall be designed to the dimensions given in CSL Drawing 2445 and drawings shall be submitted for approval.
- 18. The blast pipe shall have a plain cylinderical orifice 3½ dia. without cross-spreaders. The chimney and petticoat shall be similar to Drawing 1 YL-42.
- 19. The elbow (blower) Ref. Lett. T, Drawing 1-YL-193 shall be made in bronze to IRS Specification N 6 CL. II instead of cast iron.
- 20. The superheater elements shall have intergrally forged return bends and spherical ends.
- 21. Ring type hinges as shown in CSL Drawing 2162 shall be provided on the smokebox self-cleaning apparatus table plates in lieu of flap plate hinges, Ref. Let. Z of Drawing 1 YL-46.

#### Boiler Mountings.

- 22. The top feed clack box shall be as shown in CSL Drawing 1718 in lieu of Drawing 1 YL-87.
- 23. Whistle connection of reduced orifice, Ref. Let. A of CSL Drawing 2163 shall be provided in lieu of Ref. Let. of Drawing 1 YL-70.
  - 24. The 7 m/m injectors shall be in accordance with I. R. Part Drawing LA/YR-156.
- 25. The skirt on the gland nut of the top gauge column cock, Ref. Let. M, Drawing 1 YL -71, shall be reduced by 1" in length.
- 26. The lamp brackets for gauge glass lamps shall be repositioned to suit the lowered gauge column. Gauge column blow throw cook and protector shall be to I. R. Part Drawings listed in Appendix V.

#### Clothing

27. The clothing arrangement of the boiler shall be revised to suit the preceding modifications.

#### XII. Frame.

(Clause 35 of Standard Specification)

Drawing reference: E/SL-304/2, 80, 81, 98.

The main frames of the locomotive are to be built of rolled steel plate 1' thick, adequately braced by a horizontal racking plate and suitable fabricated steel cross strecthers. These frames are to be located outside the coupled wheels, after the usual Narrow Gauge practice. The portion of the main frame behind the coupled wheels and over the trailing truck shall be made wider to accommodate the wide firebox and ashpan. The arrangement shall follow generally drawings E/SL-304/2, 80 & 81. In the design of the hind end of the main frame, provision shall be made for a lateral movement either way of  $3\frac{1}{2}$  for the hind truck.

The distance between the frame plates shall be increased to  $3'-10\frac{1}{2}''$  to provide adequate clearance between the frame and spring buckle.

The frame plates shall have a  $\frac{1}{4}$  radius provided on the horizontal and radiused portions of the frame edges of the horn guides.

Lifting shackles shall be provided at both ends of the engine. The front shackles befitted at holes in front of the frame and at the rear on the lifting bolts as in the exhibited drawings.

Datum pads as specified in the Standard Specification shall be provided for location of coupled axle centres.

Horn stays and frame clips generally to drawing E/SL-304/98 shall be fitted.

#### XIII. Buffer Beam and Cattle Guard.

(Clause 36 of Standard Specification).

Drawing reference: E/SL-304/174 & 94.

The buffer beam at the front end of the engine is to be made of steel attached with snap head rivets to the drag casting and shall be suitable for use of the buffer couplers shown in the exhibited drawings.

A Standard design of cattle guard to Drg. E/SL-304/94 is to be provided at the front end of the engine.

The front drag casting shall be designed with pockets for filling in lead if required to obtain the minimum axleload on the front truck.

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#### XIV. Hind Drag Casting.

(Clause 37 of Standard Specification).

Drawing reference: 1 ZP-95, 190.

The hind drag casting shall be generally to drawing 1 ZP-95 suitable for the application of the type of inter-drawgear shown on drawing 1 ZP-190, and shall also be arranged for the application of a lateral spring control for the hind truck.

### XV. Cylinders

(Clause 38 of Standard Specification).

Drawing reference: CSL Drawings 1622, 1860, 1534.

E/SL-304/47, 129 to 141.

I. R. Part Drawings L/CL-602, 738, 739, 741 & 603.

Cast iron cylinders with barrel liners on the lines of CSL Drawing 1622 shall be fitted outside the frame. They shall be designed with a bore of 14" initially and a stroke of 18".

The bore of the bell-mouth shall be only  $\frac{1}{2}$  larger than the nominal bore of the cylinder.

The centreline of the cylinder bore shall be horizontal and in the plane of the coupled axle centres.

The cylinder shall have valve chests designed to accommodate piston valves 8' dia. with a 6" travel. The valve chests shall take renewable cast iron liners with small rectangular ports 1.3/8" wide.

The cylinder front cover joint ring is to bear on the barrel liner and cylinder casting as indicated in CSL Drawing 1534.

The cylinder front and hind covers must conform to the solid pattern piston head specified, generally as shown in CSL Drawing 1860.

The cylinder front covers shall be on the lines of I. R. Part drawing L/CL-741. Care shall be taken that sharp corners are not left at the bottom of the breaking grooves.

The cylinder hind covers are to be steel castings, designed to provide an attachment for the slide bars and to accommodate a "Britallic" piston gland packing.

The steam chest front covers shall be to I. R. Part drawing L/CL-738 and bush to I. R. Part drawing L/CL-739.

The steam chest hind covers shall be steel castings guiding the valve spindle crosshead following the general features in drawing E/SL-304/136. Grease grooves shown on Ref. Lets. C & D on drawing E/SL-304/136 are not to be provided.

The cylinders shall be insulated with asbestos mattresses and cased in suitable steel sheets.

The cylinder drain cocks shall follow accepted IRS practice as illustrated in drawing E/SL-304/47, 138 to 141 but the valve & valve seat shall be I. R. Part drawing L/CL-602 and 603 respectively.

#### XVI. Slide Bars.

(Clause 39 of Standard Specification).

Drawing reference: E/SL-304/149.

The slide bars shall be arranged for use with "Laird" type crossheads, similar to drawing E/SL-304/149.

#### XVII. Piston.

(Clause 40 of Standard Specification).

Drawing reference: CSL drawing 1860.

The piston head shall be of the solid cast iron pattern, generally as shown in CSL Drawing 1860.

#### XVIII. Piston Rod.

(Clause 41 of Standard Specification).

Drawing reference: E/SL-304/147, 148.

The piston rod shall fit into the piston head by a taper secured with a nut and into the crosshead by a double taper connection on the lines shown in drawings E/SL-304/147 & 148.

#### XIX. Crosshead, Cudgeon Pin & Slide Block.

(Clause 42 of Standard Specification).

Drawing reference: E/SL-304/148.

CSL Drawing 1628.

I. R. Part drawing L/PX-630 & 314.

The crosshead shall be of the "Laird" type made of cast steel to drawing E/SL-304/148. The crosshead slide block shall be modified generally as shown on CSL Drawing 1628.

The gudgeon pin and plug shall be to I. R. Part drawings L/PX-630 and 314 respectively.

#### XX. Piston Valve, Bye-Pass Valve, Etc.

(Clause 43 of Standard Specification).

Drawing reference: I. R. Part drawings L/PV-632, LA/CL-151, 152 & 155.

The piston valves are to be of the plug type on the lines of I. R. Part drawing L/PV-632 designed for 8' bore of steam chest liner and shall have 4 rings per head, each 5/16' wide. The width of each head shall be such as to give a steam lap of 1½' and nil exhaust lap.

Bye-pass valves of the NC type as shown in I. R. Part drawing LA/SL-155 shall be fitted.

One relief valve as shown in I. R. Part drawings LA/CL-151 & 152 shall be fitted to each cylinder cover.

#### XXI. Valve Spindle And Crosshead.

(Clause 44 of Standard Specification).

Drawing reference: 1 ZP-125.

The spindle of the piston valve which will have a maximum travel of 6", shall have a taper fit in a crosshead type of valve spindle guide. The end of the piston valve spindle is to be 1/8" clear of the bottom of the crosshead after it has been tightly drawn up by the cotter, the fitting surfaces of the spindle and crosshead socket being first machined to a specified taper and then finally ground together to ensure adequate surface contact.

#### XXII. Motion.

(Clause 45 of Standard Specification)

Drawing reference: E/SL-304/152 to 165.

I. R. Part drawing L/MN-661.

1 ZP-133, 134, 136, 137 & 138.

The motion shall be a "Walschaerts" valve gear designed to provide 1/8" lead, 1½" steam lap and nil exhaust lap. The maximum values of the full back gear position of the reverse lever shall correspond with cut off of at least 80 per cent.

The motion shall be arranged for soft grease lubrication generally as shown on drawings E/SL-304/152 to 165.

SKF roller bearings shall be provided for the return crank end of the eccentric rods.

The die block shall be of steel class I to IRS Specification M. 3, case hardened on the wearing surfaces and shall be lubricated from a single nipple feeding grease into three points as shown in drawing L/MN-661. The clearance between the die block pin and the die block shall range between 0.004" & 0.005" to suit soft grease lubrication.

All motion pins shall be of the parallel type in accordance with IRS practice and are to be secured by solid taper pins. The motion pins shall be lubricated by soft grease.

The motion pin holes shall be bushed with phosphor bronze to IRS Specification N-6, Class I.

The reversing screw bracket shall be carried on a support independent of the boiler and shall be designed for a rigid attachment to the main frame on the right hand side.

The reversing screw arrangement shall be as shown in drawings 1 ZP-136, 137 & 138. The reversing shaft spring shall be provided generally as shown in drawings 1 ZP-133 & 134.

### XXIII. Connecting Rod:

(Clause 47 of Standard Specification)

Drawing reference: E/SL-304/150.

The connecting rods shall generally follow the design shown in drawing E/SL-304/150.

Lubricarion of the little end shall be by soft grease through the gudgeon pin. Lubrication of the bigend shall be by hard grease from the top of the rod.

### XXIV. Coupling Rods:

(Clause 48 of Standard Specification).

Drawing reference: E/SL-304/151.

The coupling rods are to be of rectangular section and shall follow the drawing E/SL-304/151; but their length shall be modified to suit the coupled wheel spacing of 'WG' locos.

The rods shall be arranged for hard grease lubrication from the top of the rods.

The edges of all lubricating holes are to be rounded and polished.

#### XXV. Coupled Wheels:

(Clause 49 of Standard Specification).

Drawing reference: E/SL-304/100, 103 to 105.

The coupled wheels shall be of the spoked pattern with cast steel centres fitted with tyres following the practice in drawings E/SL-304/100 and 103 to 105. Cast iron hub liners in halves shall be fitted on the coupled wheel centres as shown in drawing E/SL-304/100.

The whole of the revolving masses and 33 per cent of the reciprocating masses shall be balanced and cross-balanced. The distribution of the reciprocating balance shall be as follows:-

Part of this balance may be arranged in the design of the fly cranks. The full calculations for balance including cross-balancing shall be submitted to the Central Standards Office for Railways, Chittaranjan, for approval, and a copy shall be included in the "As Made" drawing set.

#### XXVI. Axles:

(Clause 50 of Standard Specification).

Drawing reference: E/SL-304/101, 102.

CSL drawings 1537, 1538. LSC drawings 316, 317, E/11093-86, 87, 88.

The coupled axles and fly cranks may be designed on the lines of those of the 'ZE' class locomotives shown in drawings E/SL-304/101, 102.

The cranks-pins may be detachable as shown on LSC drawings 316 & 317 and CSL drawings 1537 and 1538; but crank-pins integral with fly cranks as shown on drawings E/11093-86, 87 & 88 shall be preferred.

#### XXVII. Coupled Axle Boxes:

(Clause 53 of Standard Specification).

Drawing reference: E/SL-304/99.

I. R. Part drawing LA/AB-634 to 637.

The coupled axle boxes shall be in solid bronze and shall generally follow I, R. Part drgs. 634 to 637.

"Ajax" hard grease lubrication shall be provided for the journals and oil lubrication for the horns.

The wheel hub and axle box face liners shall be as large as practicable.

#### XXVIII. Axle Box Guides:

(Clause 54 of Standard Specification).

Drawing reference: E/SL-304/98, 124.

E/SL-121/159.

CSL drawing 2164.

The axle box guides shall be of cast steel and may follow drawing E/SL-304/98, though the continuous type of guides shown in Drawing E/SL-121/159 is preferred if this design can be accommodated. Wedges shall be provided as shown in these drawings.

The wearing faces of the wedges and of the guides bearing against the axle box shall be lined with 11 to 14% manganese steel liners. The liners shall be secured by welding on the lines of CSL drawing 2164.

The total lateral play initially of the coupled axles in the main frame shall be as follows:-

 Leading Coupled Axle
 3/16"

 Inter Coupled Axle
 3/16"

 Driving Axle
 3/16"

 Trailing Coupled Axle
 3/16"

It may be noted that the side plays quoted above are equal to twice the hub and horn-clearances provided on either side of the locomotive.

The frame clips and axle box wedges shall be generally to the design shown in drawing E/SL-304/98.

## XXIX. Bearing Springs, Links & Brackets:

(Clause 55 of Standard Specification),

Drawing reference: E/SL-304/107, 108.

CSL drawing 2183.

The bearing springs over the coupled axles shall be of the laminated type and shall each consist of 13 plates 3" wide and 3/8" thick with a span of 2'-6" and shall be interchangeable with the springs shown in drawing E/SL-304/107. Spring plates shall be of silicomanganese steel oil hardened quality with identification grooves to CSL Dg. 2183.

Spring hangers shall be of the straight link type shown in drawing E/SL-304/108.

Auxiliary springs are not required.

The locomotive shall be arranged on three-point suspension, one point being the Cross-Compensated group of the front truck, leading coupled and inter coupled wheels, and the other point beings the compensated right hand and left hand groups of the driving, trailing coupled and hind truck wheels.

The compensating beams are to pivot on pins lubricated by soft grease on the lines indicated in the exhibited drawings.

# XXX. Platforms, Splashers, Foot-Steps, Hand-Rail, Cab, etc.

(Clauses 56 to 58 of Standard Specification).

Drawing reference: E/SL-304/179 to 184.

CSL drawing 2445.

1 ZP-178

The design shall follow generally the exhibited drawings, but the front plates of the cap bearing the lookout windows may be inclined as shown in CSL Drawing No-2445.

Cap louvres shall followed generally drawing 1 ZP-178.

# XXXI. Sand Boxes And Gear:

(Clause 59 of Standard Specification).

Drawing reference: E/SL-304/109 to 112.

I, R. Part drawings LA 5 D 001,

L 5 D 002,

L 5 D 003,

L 5 D 004.

Gravity dry sanding is to be provided on the leading coupled wheels only, operated from the left hand side of the footplate. The sand box lids are to be the design shown on IR Part drawings LA5D001, L5D002, L5D003 and L5D004.

# XXXII. Combined Buffer & Drawgear :

(Clause 60 of Standard Specification).

Drawing reference: E/SL-304/175, 176.

ABC Centre Buffer and Coupler is to be fitted to the front of the engine (and back of tender) as shown in the exhibited drawings.

#### XXXIII. Intermediate Drawgear:

(Clause 61 of Standard Specification)

Drawing reference: ZP-106, 190.

The intermediate draw and buffing gear between engine and tender shall generally follow the design shown in drawings 1ZP-190 & 106.

#### XXXIV. Brakes:

(Clauses 62 of Standard Specification).

Drawing reference: E/SL 304/166 to 173.

A steam brake is to be fitted to the engine generally as in in the exhibited drawing set E/SL-304, the rigging having soft grease lubrication.

The brake blocks are to be of the standard pattern shown on drawing E/SL-304/168. The clearances between the new blocks and the pins and the surrounding parts are to be adequate

Safety straps are to be provided for all brake pull rods and brake shafts.

A vacuum brake ejector of the SJ 'P' type righthand pattern with G & G graduable steam brake valve is to be fitted and vacuum piping fitted to the engine for working the train brake in accordance with the Standard Specificiation. Davies & Matcalfe, 'M' type ejector will be accepted as alternative to the SJ R. H. pattern type 'P' specified but a G&C Graduable automatic steam brake valve shall also be provided in this case.

Vacuum brake fittings shall be selected from the IRS fittings shown on IRS Part Drawings listed in Appendix V

#### XXXV. Front & Hind Trucks :

(Clause 63 of Standard Specification).

Drawing reference: E/SL-311/121 to 129 & 139.

E/SL/304/121 to 128.

The front truck shall be similar to the design employed in 'ZB' class locomotives, and shall follow drawings E/SL-311/121 to 129 and 139, except that the bottom half of the axle box shall be redesigned in three sections to facilitate repacking of axle box without the need for removing the wheel-set for this purpose.

The front truck wheels shall be 2'-0" in diameter at the tread.

The front truck shall have a lateral movement of not less than  $2\frac{1}{4}$ " either way, and the control shall be of the swing link type. The initial control shall not be less than 5 ton and the final control shall not exceed 1.7 tons under the maximum lateral movement of  $2\frac{1}{4}$ ".

The hind truck shall follow drawings E/SL-304/121 to 128. The truck shall have a lateral movement either way of not less than  $3\frac{1}{2}$ . The spring crack-off shall be 0.4 tons effective at wheel-rail, and the maximum value at a travel of  $3\frac{1}{2}$  shall not exceed 1.0 tons.

The fraction fabric liner. Ref. Let, B of drawing E/SL-304/128, shall be substituted by a suitable phosphor-bronze liner arranged for oil lubrication.

11 to 14 per cent manganese steel liners shall be fitted to axlebox guides as shown in the exhibited drawings.

The hind truck wheels shall be 2'-3" in diamter at the tread.

#### XXXVI. Lighting Epuipment :-

(Clause 64 of Standard Specification).

Drawing reference: E/SL-304/193 to 198.

CSL Drawing 2161.

I. R. Part drawing C 1642.

Lighting equipment is to be supplied in accordance with the Standard Specification.

Two plug points are to be provided one on either side of the running board for use with a portable electric lamp with flexible connection. Arrangement shall be to the approval of the Central Standards Office for Railways, Chittaranjan.

Oil burning buffer lamps to CSL drawing 2161 complete with burner to IRS part drawing C 1642 shall be supplied at locations shown in the exhibited drawings.

#### XXXVII. Tools:

(Clause 65 of Standard Specification).

Drawing reference: I. R. Part Drawings LA/EQ-153 & 154.

Complete sets of tools and outfit are to be supplied in accordance with the Stannard Specification. The firing shovel shall be in accordance with I. R. Part Drawings LA/EQ-153 & 154.

One inspection light with 50 feet of flex shall be included.

Two 15-ton lifting and traversing screw jacks with ball bearings are to be supplied.

XXXVIII. Pipe Couplings & Connections, Screw Threads, Etc.

(Clause 82 of Standard Specification).

Drawing reference: CSL drawing 1720

I. R. Part drawings LA/PC-55 to 59.

Pipe couplings and connections are to be of the standard design shown in CSL drawing No. 1720 for copper pipes upto  $1\frac{1}{2}$  dia. and I. R. Part drawings LA/PC -55 to 59 for all steel pipes and copper pipes over  $1\frac{1}{2}$  dia.

#### XXXIX. Means Of Lubrication:

(Clause 84 of Standard Specification)

Drawing reference: CSL drawing 1680.

Cylinder lubrication shall be provided by a two-feed Wakefied A. C. pattern hydrostatic sight feed lubricator of 3 pints capacity

Auxiliary oil box and soft and hard grease nipples shall be of the design shown in the IRS Part drawings specified in Appendix V of this Particular Specification, but grease nipples of approved make to the dimensions shown on CSL drawing 1680 will be accepted as alternative to those shown on I. R. Part drawings. Grease nipples and adaptors whenever used shall be tack welded.

The lubrication of details other than the main cylinder shall be as follows:-

Axle boxes, coupled

... Hard grease.

Axle boxes, carrying

... Oil.

Bigends & Coupling Rods

.. Hard grease.

Motion

... Soft grease lubrication.

Pivot, for front truck, hind truck

... Oil

Axle box horns

... Oil lubrication from oil boxes, suitably

located for the purpose.

Slide bars

... Oil lubrication.

Compensating beam pins.

... Soft grease lubrication.

#### PART D

#### Detail Tender Design Requirements.

The tenders are to follow the Standard Specification R. 32-54 and CSL drawing 2445; and shall be built in accordance with Central Standards Office for Railways, drawing set I ZPT-1 to 49 except that the axleboxes shall be to drawing E/SL-354/12 and the frame and axlebox guides shall be modified to suit.

The following clause indicates the principal requirements in the design of the tender:-

#### XL General Requirements & Dimensions :

(Clause 85 of Standard Specification).

Drawing reference

... CSL drawings 2445 & 1ZPT 1 to 49

Coal capacity

4 Long Tons.

Water capacity

1700 Imperal Gallons.

Axle load

7.0 tons maximum.

Tender wheels-diameter on tread

2'-6".

#### XLI. Drawings And Tracings:

(Clauses, 90, 91 and 92 of Standard Specification).

Drawing reference: CSL drawings 2000, 2001, 2015, 2016

ESL-304 and 1ZPT sets.

The requirements of Clauses 90, 91 & 92 of the Standard Specification are to be strictly adhered to. "As Made" tracing shall be in linen, and shall be indexed on the lines of E/SL-304 and E/ST-354 drawing sets, and the necessary changes indicated in CSL drawings No. 2015 and 2016 shall be incorporated. CSL drawing No. 2000 & 2001 which give the sizes of sheets, general make-up, nomenclature of items, schedule of meterial particulars, machining symbols shall be followed.

The method of diamensioning and projection of end and plan views shall follow the E/SL-304 and 1ZPT drawing sets.

Particulars regarding the numbering of the drawing sets will be advised later.

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#### APPENDIX I

CSL Drawing 2455 shows the tentative outline of 2-8-2 type Locomotive Engine and Tender now required and is included for general guidance only.

This drawing is exhibited with the other drawings listed in appendices II, III, IV & V.

Drg. No.	Description.	Relevant clause of Particular Specification.
CSL-2445 (Alt. 1)	Diagram of 28-2 type locomotive for goods service.	Parts C & D,



#### APPENDIX II

"As Made" drawing set E/SL-304/1 to 200 refer to narrow Gauge "ZE" class Locomotive Engine and is exhibited as a guide to the general practice to be followed in the design of locomotive engines now required.

"As Made" drawing set 1 ZPT 1 to 49 refer to Narrow Gauge "ZP" class Locomotive tender for 2 8-2 type Locos now required shall be indentical with the ZP tenders illustrated in drawing set 1 ZPT-1 to 49 except that plain bearing axle boxes shall be fitted instead of roller bearing axle boxes shown.

"As Made" drawings 1 YL-13 to 93, 182 and 193 refer to Metre Gauge YL class Locomotive boiler. The 2-8-2 Locomotive engines now required shall be fitted with the same boiler as on YL class locomotive with additional modifications listed (in part C) of this Particular Specification.

"As Made" drawings	Description	Relevant clause of Particular Specification.
E/SL-304 1 to 200.	2-8-2 type 'ZE' class locomotive built against Contract No. H 2439/2500 of 1948.	Part C.
1 EPT 1 to 49.	Six wheel tender with water and coal capacities of 1700 gallons and 4 tons respectively built against Contract No. 53-145-1 RE-S of 1953.	Part D.
1 YL-13 to 93, 182 & 193.	'YL' class locomotive boiler built against Contract No. K/2286A/RO/459 of 1950.	Clause XXI Paras 1 to 27.



# APPENDIX III.

"As Made" drawings other than those quoted in Appendices I & II illustrative of particular features to be embodied in the design of Locomotive engines and tenders now required in modification of the design shown on the exhibited drawings listed in Appendix II.

"As Made" Drg. No.	Last Alt. No.	Description.	Relevant clause of Particular Specification
E11093/86		Wheels-L, I. & T & L. I. Cranks.	xxvI
87		Wheels-D & T Cranks.	xxvi
88	•••	Crank-Driving & Axles.	XXVI
E/SL-121/159		Coupled Axlebox Guides.	XXVIII
E/SL-217/25		Boiler Elevation Hind End	XI (12)
E/SL-311/121	***	Pony Truck General arrangement.	xxxv
122		Pony Truck Centre	xxxv
123		Pony Truck Compensating & Axlebox Details.	xxxv
124		Front Bogie Centre Casing.	xxxv
125		Pony Truck Centre Carrier	xxxv
126		Pony Truck Wheels and Axles.	xxxv
127		Pony Fruck Axlebox.	xxxv
128		Front Bogie Spring Links and Details.	xxxv
129		Front Bogie Oiling arrangement	xxxv
139		Pony and Trailing Trucks Details.	xxxv
E/ST-354/12		Tender Axlebox	Part D .
1 ZP-30		Ashpan & Firegrate arrangement Elevation & Plan	XI (16)
31		Ashpan & Firegrate arrangement End Elevation.	XI (16)
32		Ashpan.	XI (16)
33	•••	Ashpan Bottom Door & Operating Gear Details.	X1 (16)
34		Ashpan Drench Pipe & Details.	XI (16)
95		Hind Drag box.	XIV
106	•••	Frame Details.	XI (15),
125		Piston Valve & Spindle.	XXXIII
133	***	Reversing Gear arrangement.	XXII
134		Reversing Shaft.	XXII
136	•••	Reversing Screw arrangement.	XXII
137	•••	Reversing Screw Details. Sheet—1.	XXII
138	•••	Reversing Screw Details Sheet-2.	XXII
178		Cab Shutter, Slide & Reversing Gear Casign.	xxx
190	•••	Intermediate Frawgear arrangement.	XIV, XXXIII

#### APPENDIX IV

Central Standards Office for Railways drawings of series CSL, LSC or I. R. Part Drawings illustrative of Particular features to be embodied in the design of locomotive engines and tenders now required in modification of the design shown in the exhibited drawings listed in appendix II.

Series.	Drg. No.	Last Alt.	Description.	Relevant Clause of Particular Specification
LSC	316	•••	L. Int. & Trg. cranks with detachable crank pins.	XXVI
	317	•••	Dr. Crank with detachable crank pin.	XXVI
CSL	1534		Cylinder joint ring to prevent movement of cylinder liner.	xv
	1537	2	Leading crank pin.	IVXX
	1538	***	Inter, Driving & Trailing Crank pins.	XXVI
	1622	2	Modified cylinder to take liners.	xv
	1628	2	Cast steel "Laird" type crosshead.	XIX
	1680	1	Governing dimensions for soft & hard grease nipples.	XXXIX
· :	1860	1	Solid pattern piston head.	XV&XVII
	1950	2	Typical flanged manhole seating.	XI (II)
	1984	1	Provision of additional steam cock between lubricator & steam stand.	Appendix VIII
	2000	. 3	Location of standard tables & particulars of stamping "as made" drawing set for engine.	XLI
	2001	3	Location of standard tables & particulars of stamping "as made" drawing set for tender.	XLI
	2015	•••	Typical index sheet of "as made" drawing set for Engine.	XLI
	2016	***	Typical index sheet of "as made" drawing set for Tender.	XLI
	2162	1	Ring type hinges for smoke box self-cleaning flap plates.	XI (21)
	2164	. 2	Frame pedestal shoes, wedges and liners.	xxvIII
I, R. Part.	L/AB-634	•••	Coupled axle box,	XXVII
	635	•••	n n	,,
	636	•••	P 10	,,
	637	•••	Coupled axle box cover plate.	,,
	L/CL-741	***	Cylinder front cover.	xv
	L/MN-661	•••	Radius Rod Die Block.	XXII
	L/PV-632	1	Piston valve head.	xx

# REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE APPENDIX V

Central Standards Office for Railways drawings in series CSL and I.R. Part drawings in series C, L & VB illustrative of a range of standardized dimensions and fittings to which the locomotive Engines and Tenders now required must comply and from which the fittings included in the design must as far as possible be selected.

Series	Drawing No.	Last Alt. No.	Description	Relevant clause of Part Speci- ficatiod
1	2	3	4	5
M/s R.P.&T.	Sketch 602	•••	Maximum and minimum moving dimensions (2'-6" Gauge).	x
CSL	1718	2	To, feed clack box.	XI (22)
	1720	2	Cone joint connection for copper pipes.	XXXVIII
	2161	3	Buffer lamp.	XXXXI
	2163	1	Modified whistle connection.	XI (23)
·	2183	. 1	Identification grooves in laminated bearing spring plates oil hardened quality.	xxix
	2365		Foundation ring.	XI (15)
	2411		Provision of baffle plate in dome.	XI (5)
IR Part	C-1642	i	Dubber burner.	xxxvi
I R Part	LA/BM-151	17		
	L/BM-601			
	602	1	A 100 A	
	603		Gauge glass protector assembly and components	XI (23)
	604			
	605			
	607	"	921 V V A V	
	LA/BM-152		443.434	
	L/BM-625	"n	(1) (2) (2)	
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	627		सन्यमेव जयते	
	628			
	629	· · · · ·	Gange column blow through cock assembly & com-	XII (26)
			ponents.	
	630	1 1		
	631	"		
	632	J		
	LA/BR-151	۱ ٦		
. !	152	"		
	169			
	171	· · · · ·		
	172			
	L/BR-602	;		
	604			
	613			
ŀ	614	}	Inspection & mud hole doors assemblies and components	XI (14)
	615			
	616			
	6:7			
	707			į

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# APPENDIX V (Contd.)

1	2	3	4	5
	L/BR-708			
	760	ı İ	·	
	761		·	
	L/NT-129			
	130	j		
IR Part	L/CL-602	2	Cylinder Droin cock value	xv
	603	3	Cylinder Drain value seat.	xv
ľ	738	•••	Steam chest front cover,	ΧV
	739		Bush for steam chest front cover.	ΧV
IR Part	LA/CL-151	,		
	152	)		
	L/CL-604			
	605			
	606		Cylinder relief valve assemblies & components.	xx
	607	}	<u>.</u>	
	608		}	
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}	610			.*
	LA/CL-155	1		
	L/CL-618		VARITY	
	619	•••	TRANT	
j	626	1		
	627			
,,	628	}	Bye pass valve (N.C. type) assembly & components.	XX
Ì	724			
}	L/SU-24	1	] }.	
{	25	1	·	
{	L/NT-205		·	
	207	}		
	LA5D001	  ;		
	L5D002			
	L5D003	}	Sand box lid assembly and components.	xx
	L5D004	]		
	LA/EQ-153	1 1	Firing shovel 36 inches.	
	154	1	Firing shovel Handle.	XXXVII
}	LA/GL-151			
	152			• !
	154			
}	155			! [
ļ	L/GL-601			
İ	602			
1	604			
}	605	}	Hard & Soft grease nipples assemblies & components,	XXXIX
Ì	606	" ]		

# REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE APPENDIX V (Contd.)

1	2	. 3	4	5
	607			
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	611			
	615	j		
	LA/IR-156	j		
	L/IR-624			
'   	625	1	·	
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i j	627	[		
	637	[		
	641	}	7 m/m Simplex Injector assembly & components.	XI (24)
	674			
	675			
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	678	j		
R. Part	L/IR-679	ว		
	. 680	}		
į	681			
	682		Y/N/JTV.A/V	
	683		LEA PAL	
	684	}	7 m/m Simplex Injector assembly & components.	XI (24)
	685		, 13,00	
	L/SU-76		सत्यमेव जयत	
	156			İ
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	LA/OC-151	· · · · ]	,	
	152			
	153			
	154		•	
	155			
	L/OC-601			
	602			
	603	··· }	Oil boxes and oil cups assemblies and components.	XXXI
	604			
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	609			1
	610 ,	1 ]		

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## APPENDIX V (Contd.)

1	2 .	3	4	5
	LA/PC-55	··· )		
	56			•
	57	\ \	Pipe Unions.	XXXVIII
	58			
ŀ	. 59	J		{
	L/PX-314	4	Plug.	XIX
	630	1	Gudgeon Pin.	XIX
I. R. Part	VBA-80	-1	Reducing the connection to gauge	
*	VB-180	if	Reducing the connection to gauge	
•	VBA-84	۱		
	VB-184	2	Drip trap and valve assembly and components	<b>\</b>
	185	}	Drip (12) and varve assembly and obligorents	
	18;	ا ز ا		
j	VB-211		Duplex vacuum gauge.	
	320	3	2" Swan neck vertical.	XXXIV
	321	6	Universal coupling 2".	
	322	3	Dummy coupling 2".	
	404	3	Cage for 2" vacuum House pipe.	
	405		Coupling washer 2".	
	407	4	House pipe Clip 2".	/
	500	1	Hose pipe Inter 18" x 2".	
	505	2	House pipe 22" x 2".	

In the "as Made" tracings Indian Railways Standard Part Drawings in series C, L, VB & Y are not to be redrawn in detail. Where such parts appear in the arrangement drawings they are to be shown in outline and the I.R. Part number with alteration number to which the part is made shall be indicated on the arrangement drawing.

# REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE APPENDIX VI

Late t revisions of Indian Railway Standard Specification & I. S. Specificationss quoted in the Standard Specification R. 32-54 & this Particular Specification (Applicable to N.G. Locos.)

I. R. S. Specification No.	Year of last Revision	Addendum or Corrigendum Slip, if any issued.
1	2	3
A 3	1951	
E 9 `	1953	
H 5	1951	
н 6	1954	
H 7	1951	
н 8	1950	
H 19	1949	
H 20	1952	
H 21	1947	
М 1	1953	
M 2	1948	
м з	1949	Corrigendum No. 1 of March 1954.
M 4	1949	(Engl)
М 5	1954	
м 6	1952	
М 7	1947	
М 8	1945	(B)(H)
M 9	1953	1511117
M 11	1953	V7(2-172)
М 16	1949	
M 21	1948	सन्यमेव जयते
M 22	1950	
M 24	1953	
M 25	1949	
M 26	1953	
N 6	1949	
N 10	1954	
N 17	1949	
N 20	1950	
N 21	1953	
R 1	1954	
R 2	1954	
R 3	1933	
R 8	1954	
R 13	1954	
R 14	1947	
R 15	1951	
R 18	1953	1
R 20	1950	
R 21	1942	1

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# APPENDIX VI (Contd.)

1 .	2	3
R 22	1954	
R 23	1951	
R 24	1954	
R 26	1953	
R 27	1950	
R 29	1950	
R 32	1954	
W 1	1949	
w 3	1953	
Y 2	1949	Alternative to I.S. Specification 274.
z 1	1947	
Z 3	1949	
2 6	1951	
I.R.S. Limits & Fits to be used for Loco- motive Works.	Nov' 1950	Page 20 Alteration 1.

# I. S. Specifications

I.S. Specification No.	Year of Last Revision	Addendum or Corrigendum slip, if any issued.
274	1951	Tentative (Alternative to I.R.S. Specification Y 2)
275	1951	
	1	J.

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#### APPENDIX VII

Latest revisions of B. S. Specifications & D. G. S. & D. Specifications quoted in the Standard Specification R. 32-54 & this Particular Specification (Applicable to N. G. Locos).

B. S. Specifications

B. S. Specification No	Year of Last Ravision	Addendum of Corrigendum slips, if any issued.
1	2	3
7	1953	PD 1782 December 1953.
10 Part I	1947	Amendment PD 1157 March 1951.
10 Part 2	1926	Amendment June 1927.
10 Part 3	1929	Amendment CC 3901 April 1931.
10 Part 4	1931	
10 Fart 5	1932	
18	1950	Amendment PD 1093 September 1950.
21	1938	·
28	1932	·
31	1940	Amendment CF 9846 March 1942.
46 Part 1	1953	
46 Part 2	1929	Cancelled and suppreseded by BSS 2059.
46 Part 3	1951	
52	1952	
164	1924	
190	1925	40/40/
240 Part 1	1937	NVAL
240 Part 2	1950	TO THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF TH
334	1934	Memorandum CG 349 May 1942.
405	1945	
916	1953	Memorandum PD 1894 May 1954
1083	1951	
1452	1948	
2059	1953	Supersedes B.S.S. 46 Part 2.

#### D. G. S. & D. Sepecifications.

D.G.S. & D. Specifications	Year of Last Revision	Addendum or Corrigendum slips, if any issued.
G/Misc: 86/C	1951	

## APPENDIX VIII

#### List of Permissible Aternatives

Items not included in this list shall be in accordance with the exhibited drawings or as mentioned in this Particular Specification.

Description	Fermissible Alternatives
Material for water space stays.	(1) Steel to I.R.S. Specification M.7 Class VI
·	(2) Long strand steel.
	(3) Dunic steel.
	(4) Stag supper bibro stay bolt steel (Edgar Allen)
	(5) Stabol (Novo steel).
	(6) Tipanic (Samnel Osborn)
Blow off cock	(1) Evrit.
	(2) Everlasting
Hydrostatic Lubricator	(1) Wakefield A.C. type 2 feed having 3 pints capacity.
	(2) "Detroit" (No. 22) 3 feed having 3 pints capacity with additional I.R pattern Globe valve fitted at location shown on CSL drawing 1984.
Ejector.	(1) S J 'P' type R.H. fitted with G. & C.
*	(2) Davies & Metcalfe 'M' graduable steam brake valve.
Piston rod packing.	(1) Brittalic.
	(2) Paxton Mitchell.
Electrical Equipment.	(1) Stone
	(2) Pyle
	(3) Sunbeam

## APPENDIX IX

List of spares to be supplied against the whole set of 6, 2-8-2 type Locomotives (non-standard).

(1)	Return crank eccentric rod roller bearing.	2 (two) Nos.
(2)	Solid bronze coupled axle boxes	Half engine set.
(3)	Front truck axle box bronze bearing	2 (two) Nos. 1 Engine set.
(4)	Hind truck axle box bronze bearing	2 (two) Nos; 1 Engine set.
(5)	Coupled axle box keeps	Half engine set.
(6)	Piston rings	12 (twelve) Nos.
(7)	Piston gland cast iron packing	2 (two) set.
(8)	Eccentric rod (without roller bearing)	1 (one) No.
(9)	Hind truck control spring	1 (one) set.



#### VII—SUMMARY OF TRIALS

This summary has been prepared to secure co-ordination between Railways undertaking trials, and it is requested that separate reports be submitted in duplicate to this office by the dates given on the trial sheets.

The period of trials and general instructions are intended to serve as a guide only and may be modified at the discretion of Railways.

Reports are to be headed with serial number, title, and object of trials as described in the following summary, the body of the report being divided into the following:

- (i) Description of method of testing adopted if different to that given in the summary;
   (ii) Results as far as possible in tabular form on foolscape size paper; and
   (iii) Conclusions.

#### (a) CURRENT AND TO CONTINUE

No.	L S. C.	Railway under			General Instructions		
Trial No	Ref.	taking trial	Title of trial	Object of trial,	No. & types under Period of trial		
TLA 22	XXXIII-1 XXXV-17	All	Electric resistance welded boiler tubes.	To obtain comparative performance data of ERW and solid tubes.	Passenger 4 Goods 4 Shunting 4 In addition to 3 WG-YP engines built by CLW and TELCO.	No. of years of 2 POH (with inte- rim report after 1st POH)	
TLA 3.7	XXXV-44 XXXVI-19	Eastern	Thermic syphon butt- welded to throat plate diaphragm.	To compare the efficiency of the butt-welded design with the fillet-welded de- sign.	10 CLW built WGs	2 POH per- iods after being com missioned.	
TLB 42	XXXIX 11-12 XXXI-22, XXXV-50	Central, in co- opera- tion with re- search Dte.	Mechanical toker.	To determine wh ther me- chanical stokers are justi- fied for locos employed over sections where firing capacity is proving up to or beyond the limit of manual firing	<b></b>		
TLC 7-1	XXXIII-6, XXXV-67.	All	Expanded Metal Spark Arrestors.	To determine performance and life of the expanded metal spark arrestors as compared with standard 'Draftac'	3 locos to be fitt- ed with each of the 3 types of spark arrestors.	Life limit of the ex- panded metal spark arrestors.	
TLD 7-4	Railway Board No. 54/467/59/ M of 22-7-54.	Central	FRIEDMANN's Hydrostatic displacement lubricator, Class RN (2-feed)	To compare efficiency of lubrication, economy in oil consumption and relative maintenance costs of the 'RN' lubricator against the Standard Wakefield's lubricator in use in order to determine if the 'RN' lubricator can be accepted as a Permissible Alternative.	Loco No. 2113 YP and one fit- ted with stand- ard Wakefield's 2-feed, sight- feed, hydrosta- tic lubricator	100,000 miles or POH.	
TLD 7 5	RB letter No.54/467/ 59/M o 22-7-54	Central	FRIEDMANN'S Hydrostatic displacement lubricator, Class RN (4-feed).	To compare efficiency of lubrication, economy in oil consumption and relative maintenance costs of the 'RN' of lubricator against the standard Wakefield's lubricator in use, in order to determine if the 'RN' lubricator can be accepted as Permissible Alternative.	Loco No. 8642 WG and one fitted with standard Wake- field's 4-feed, sightfeed Hyd- rostatic lubri- cator.	1,00,000 miles or POH.	
TLE 4·3	XXXV-38	АЦ	Wedge Adjusting arrangement for plate frame locomotives.	To evolve a suitable design of wedge adjusting arrangement for plate frame locomotives.	One each of XA/XB & XD, XB/XC & XE, XA/XB/XC, XB & XD, XC, On C, E, N, S-E & W Rlys resp. on BG & one YB & YD on NR, one YB, one YB, one YB/YC and YD, and 1 YB 2 10 YD.	60,000 miles.	

# REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE VII SUMMARY OF TRIALS (Contd.)

Trial No.	L. S. C.	Railway under-	Title of trial	Object of trial	General Instr	uctions
Tria	Ref.	taking trial	Alust O1 tildi	SSJOOD OF WHICH	No. & types under trial	Period of trial
TLE 2·3	XXX1V.39, XXXV-52, XXXV1-27.		Modified dou- ble tapper form of pis- ton rod cross- head connec- tion.	To find out if this arrangement red ces maintenance cos s and performance as compared with standard double tapper pin.	2 WG class-One with trial fittings on LH side & standard fittings on RH & the other with the trial fittings on RH side and standard on LH side. The two locos with trial fitting are to be employed on the same division and on similar service.	PO. to P.O.
TLL (Mod) 2 10	XXXI 71-72, XXX'I 62, XXXIII- 47.	Central	Liners of Tatas Nimn' Brand Manganese Nickle steel in rubbing contact for compled and bogie wheel axlebox channels and guides and coupled wheel axlebox face and weel hub liners.	To determine performance of trial material and extent of wear as compared with 11-14% manganese steel and other combinations in rubbing contact.	WM-1	100, 00 miles af- ter fitt- ing trial liner.
TLL 3·3	XXIX-70, XXX-100, XXXI-75, XXXII-66, XXX 57,	S. E. (ex-BN)	Hoffmann rol- ler bearing axle boxes for inside & out- side carrying wheels.	To compare performance with carrying wheel roller bearing axleboxes of the Timken and Skefko designs with a view to determining whether the designs are suitable for acceptance as a permissible alternatives.	2 XD class locos, 1 with Hoff- main & other with Timken bearings 3 XC class locos, 1 with Tim en, 1 with Hoffmann & the third with Skefko.	P.O. to
TLL 3.4	XXIX-70, XXX-101, XXXI-76, XXXII-66, XXXII-64, XXXVI-28	South- Eastern Central	Roller bearing axleboxes for inside & outside carrying wheels.	To compare performance with carrying wheel roller bearing axleboxes of the Timken, Skefko and Hoffmann designs with a view to determining whether the designs are suitable for acceptance as Permissible Alternatives.	Ex GIP. 1 WG loco with SKF, Ex-GIP, 1 WG loco with Timken. Ex BN, 1 WG loco with Hoffmann.	P.O. to
TLL 49	XXXV-55	All	Shell Alvania Grease & 3 for tender axleboxes fit- ted with rol- ler bearings.	To standardise one type of lubricant for roller bearing axleboxes of the three makes used on locomotive carrying axles.	As detailed in the covering letter No. SL/LB/I of 30th August 1955.	
		(1	b) NEW TRIALS	ORDERED BY THE BOARD	•	•
•••	XXXVI-18 SL/FXS/ III of 30-3-56 to DR/LKO	<b>3.0</b> €	Security circulator Arch Tubes.	To compare performane of boilers fitted with thermic syphon with boilers fitted with security arch tubes only.	i WG (CLW)	•••
•••	XXXVI SL/ WG/IM SH of 1-9-56.	All ··	Regulator Locking Device to Western Railway Drawing LCB-1843. (CSL Drawing 2532)	To review alternative designs of regulator locking devices on locomotives and to decide on the future standard.	6 BG, 6 MG on each Rly.	

(b) NEW TRIAL ORDERED BY THE BOARD-Concld.

Trial No.	LSC/ CSO.	Railway under-	Title of trial	Object of trial	General instructions		
Tria	reference	taking trial		Object of that	No. & types under trial	Period of trial	
TLD 7.6	XXXVI-21	Northern	Wakefield Convergent Jet Atomiser.	To compare the relative wear and carbonation on piston valve liners and rings of locos fitted with Wakefield's Convergent Jet Atomisers as against those having conventional type of lubrication connection to the steam pipe.	4 WGs -2 Nos with Convergent Jet Atomiser & 2 Nos. with conventional type of lubrication to the steam pipe.	60 000 miles	
TLD 7.7	×XXVI-37	Central, Nor- thern S-East- ern N-Eas- tern	"Nalco" Wheel Flange Lub- rication.	To study the extent of reduction, if any, in flange wear with the use of Nalco Flange Lubricators.	Central, on BG & NG, Northern, on NG, S-Eastern, on BG, N-Eastern, on MG, class to be selected by the Railways.	One ful period be tween consecu- tive tyre turnings	
	XXXVI-17	Eastern, Central.	Ballast Sweep with streng thened cattle made.	To consider provision of ballast sweep on loco cattle.	WP		
TLG 3-12	XXXVI-24	All	Case Hardened Steel Motion Bushes.	To compare performance of casehardened motion pins working in casehardened steel motion bushes as compared with similar pins working in bronze bushes.	6 BG and/or 6 MG locos WP, WG. YP, YG for grease lubrication; Rlysto select locos for oil lubrication.	18 months	
•••	XXV/54, SI/WP/ RB of 17-8-56.		SKF Roller bearings direct mount- ed on return crank journal without the removable sleeve.		10 CLW WGs.		
		(c)	TRIALS CLOSE.	D AS A RESULT OF XXXVI	LSC.		
No.		Tit.	1.	Action take		Ref. to	

Trial No.	Title	Action taken	Ref. to paragraph of LSC
TLA 5.2	Canadian Pacific Railway design of steel washout plugs on 2 front bottom corners of firebox.	As two-way washout plug was accepted by the XXXII LSC, trials with Canadian type of washout plugs were discontinued.	XXXVI-6
TLC 4.1	MVR pattern superheater headers having valves on the saturated side.  MVR pattern superheater headers having valves on the saturated side and provided with anti-vacuum valve.	MVR header with valves on the superheat side to be used on renewal boilers fitted with this type of header.	XXXVI-33

# VIII—Summary of Modifications authorised by the Railway Board in connection with the recommendations the XXXVI meeting of the Locomotive Standards Committee.

- 1. The application of these modifications to I.R.S. Locomotives placed in service before 1947 is optional, but Railways are advised, in their own interest, to incorporate these modifications when renewals of parts become necessary except, where expressly stated otherwise.
- 2. The application of these modifications to I.R.S. Locomotives placed in service after 1947 is obligatory and must be carried out in accordance with Railay Board's orders.
- 3. Drawings quoted under column "Sample drawings" in the table indicate the type to drawings on the lines of which the modification is to be carried out.
- 4. Under the column "Loco and Drawing reference", the class of Locomotives to which the particular modification is applicable is indicated. Drawing Nos., if prepared, are given below the class of Locos. When a modification is applicable to all IRS Locos, a remark is inserted to that effect. Drawings so far prepared for particular Locos are indicated, although the modification is applicable to other classes of Locos as well for which drawing have not yet been prepared.

Group Modifica- tion No.	Kei Fara of XXXVI LSC.	Description of Modification	Sample Drg.	Loco and Drg. Reference	Remarks.
AB.2.061	1	Axlebox lubricator keep end plate of FABLICATED DESI N, providing for adjustment to meet the reduction in axle diameter and thickness of axle box crown due to wear, to be standard.	*CSO Sk. L-365 Alt: 1, CSO Sk. L-366 Alt: 1.	All IRS Locos. WP: WG CSO Sk: *L-365, 366.	<ol> <li>For permissibe alteration see: Mod AB.2.062</li> <li>CSO Sk. L-365 is not apapplicable to WP Locos when Modified to WP.AB. 2.064</li> </ol>
AB.2.062	1	Axle box lubricator keep end plate of CAST IRON providing for adjustment to meet the reduction in axle journal diameter and thickness of axle box crown due to wear to be a permissible alternative to fabricated design.	*CSO Sk. L-363 Alt: 1 CSO Sk. L-364 Alt: 1	All IRS Locos  WP: WG  CSO Sk. *L-363, 364.	(1) See Mod: AB.2.061 (2) (SO Sk. L-363 is *not applicable to WP Locos. When modified to AB.2.064
AB.2.063	38 (iii)	Axle boxes/axle box bearings and hub liners to be modi- fied to provide lead-in-lubri- cating grooves.		All IRS Locos.	
AB.2.064	41	Leading and trailing axle boxes and grease cellar equipment of Wr Locos to be modified to suit 8.3/8" axle journa diameter.	-	WP  CSL 2285 alt:3 & CSL 2599.	(1) connect with Mod: WL.4.012 (2) For existing Locos axle. (3) New Locos to be provided with Roller bearing axle boxes see Mod: AB.4.002.
AB.4.002	40	Roller bearing axle boxes to be provided on coupled axle of WP Locos.		WP	For all new builds.
AN.2.010	6 10	Ashpans suitable for built- up cradle casting to be mod- fied.		WP.WG.  CSL 1853 alt;3, CSL 1854 alt;2 CSL 1855 alt:6	(Connect with Mod:FR.4.034 For new builds and replace ment for modification to existing ashpans see Mod AN 2.021.
AN.2.018	10	Ashpan suitable for one piece cradle casting to be modified.		WP. WG.  CSL 2295 alt:1, CSL 2296 alt:1 CSL 2297 alt:2	(Connect with Mod:FR.4.034) For new builds and replace ment for modification to existing Locos. See Mod AN.2.021.
AN.2.020	3	Ashpan hopper door opera- ting rod jaw and dust keep- er modified.		WP:WG  CSL 2461 Alt:1	To be future standard.
AN.2.02	1 10	Ashpans (Existing) modified		WP:WG CSL 2459 Alt:3	For existing Locos only, For new builds see Mod: AN 2.016 & 018.

	Ref Para of XXXVI LSC.	Description of Modification	Sample Drg.	Loco and Drg. Reference	Remarks
BE 2,032 BE 3,019 BE 4.037 BE 2,020	5	Friction fabric liners on trucks and bogies to be of 'RAILKO ALL' brand.		All I.R.S. locos.	To be standard pending re sults of trial.
BE 3.016	4	Lubricating arrangement of pony truck centre pin modified.	*CSL-2146 Alt: 4 +CSL Sk.L 290 + & CSO Sk. L-526.	YG  CSL 2146, CSO Sk. L-236 YL  CSL 2146, CSO Sk. L-290	*For Existing Locos +For new builds
BG.2.034	34 (1)	Revised arrangement of tender brake rigging.		WP: WG CSL Sk. L-343, L-368 At: 1	
BM.2.045	7(11)	Washout plug to be provided on top of boiler ahead of clack box.	CSL 2519 Alt: 1	All IRS Locos  WP:WG YP:YG  CSL 2519 CSL 2515 Alt: 2  WM  CSL 2318	See Mod : BR.2.022
BM 2.046	7(1)	Washout plugs on front tube: Two at the side to be replaced by two plugs between the tubes and flues.	CSL 2519 Alt:1	All IRS Locos.  WP: WG  CSL 2519 Alt: 1  YP: YG  CSL 2515 Alt: 2	For new builds.
BM: 2.04	7 7(ix)	Cast steel washout plug seatings to be replaced by stiffering plates for all Locations except at the bottom corners of fire boxes.	CSL 2519 Alt:1 and CSL 2530	All IRS Locos.  WP: WG  CSL 2519 & 2530  YP: YG  CSL 2515 & 2531  Alt: 1	Standard practice to be adopted for all new locos.
BR.2.022	7 (ii)	Mud hole door in vicinity & clack box to be omitted on new builds when washout plug is provided on top of boiler ahead of clack box as per Mod: BM.2.045		All IRS Locos	Also See Mod: BM.2.045 Standard practice to be adopted for all new Locos.
BR.2.024	7(iii)	Inspection doors on hind bar- rel to be located above top row of flues and tubes as far as possible.		All IRS Locos.	Standard practice to be adopted for all new boilers.
BR.2.025	7(v)	Inspection door to be provided in lieu of mud hole doors on outer firebox wrapper plate as far as possible.		All IRS Locos.	Standard practice to be adopted for new boilers.
BR.2.026	7(iv)	Mud hole doors at corners of firebox throat flanges to be located as high as possible.		All IRS Locos.	Standard practice to be adopted for all new boilers.
BR.2.027	7(vi)	Mud hole doors to be provid- ed on firebox back plate in lieu of washout plugs at mid sections		All IRS Locos.	

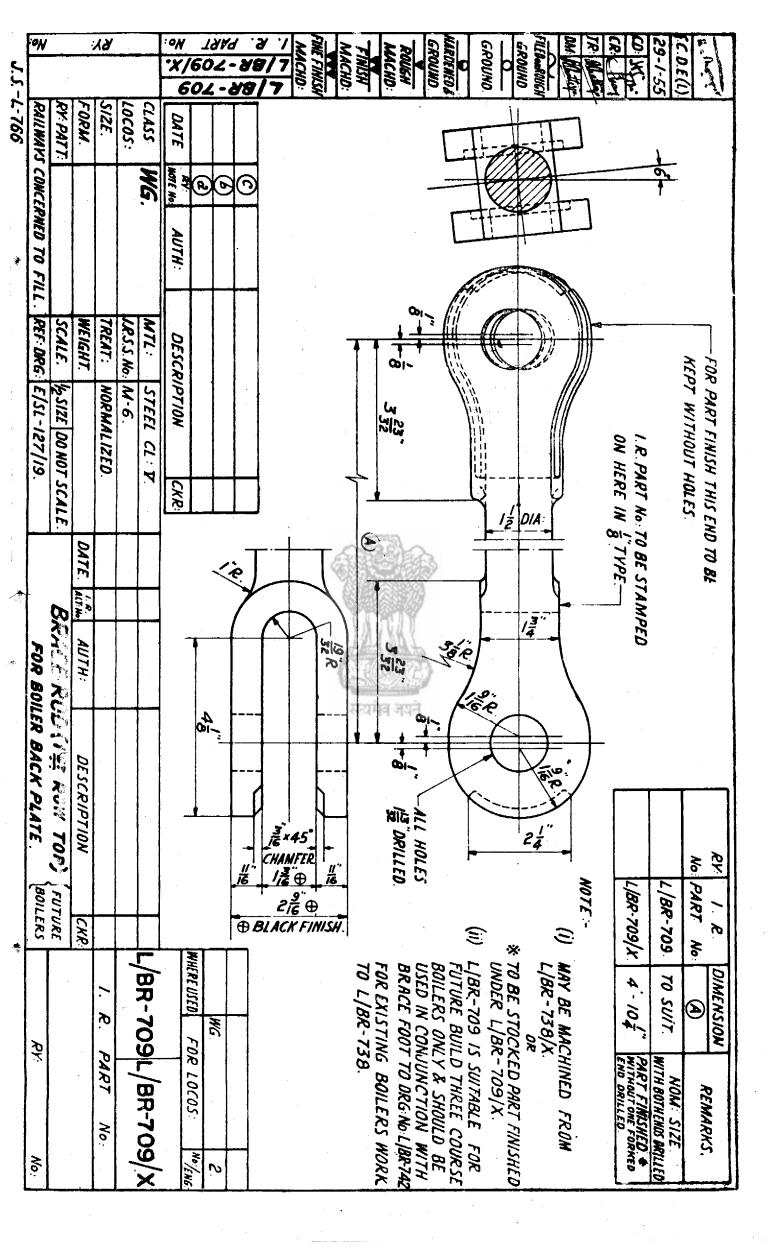
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REPORT OF THE XXXVI LOCOMOTIVE STANDARDS CONMITTEE

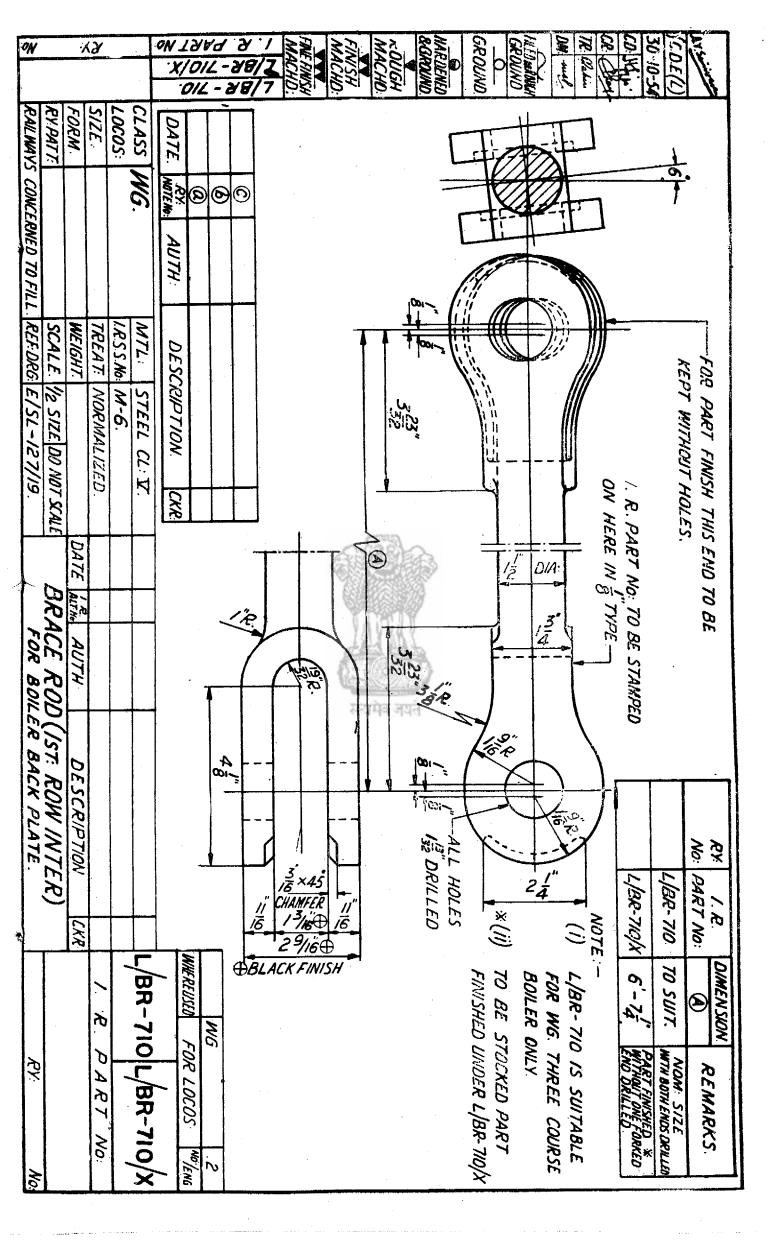
Group Modifica- tion No.	of X> XVI	Description of Modification	Sample Drg.	Loco and Drg. Reference.	R emarks
BR.2.028	7(xi)	Axis of inspection and mud hole doors to be horizontal		All IRS Locos.	Standard practice to be adopted for all new boilers.
BR.3.036	11	Revised design of brace feet and br ce rods to be pro- vided on new boilers.	I.R. Part L/BR 700 to 722, 724, to 737, 742,	WP.WG:YP:YG.	
		Brace feet to ref: letters G & K of drawing F/SL 126/90 to be replaced by brace feet to IR Part drg. L/BR-742 on existing boilers.	745, 746,		
CB.2,28	7 (viii)	Cab platform floor plates to be modified to facilitate easy access to washout plugs rear bottom c rners of fire- box back plates.		All IRS Locos (as necessary)	
<b>C</b> )	13	Ventilating slots to be provided in 'bullet nose' of streamlining.		WP CSL.2542.	
CL.5.008	25	Slide bar lubrication to be arranged from oil boxes located on slide bar brackets or convenient places.	CSL 2465 Alt: 1	WP WG CSL 2465 CSL 2505 WM WL.	
				CSL 2506 YP YG CSL 2508 CSL 2507 YL YM. CSL 2 09	
CR.2 039	39(c)	Coupling rods end of floating bushes to be relieved to clear increased fillet radius on crank pins.	स्थापन ज	For All Locos.  WP.  L/CR-658, 659, 660, 630 & 629 Alt: 1 WG.	Connect with Mod:WL.5.021
CR.2.040	39(f)	Coupling and connecting rod floating bushes to have lubricating holes countersunk on both sides.		All IRS Locos	-
€CR.2 041	39(a)	Coupling rods and bushes to be of modified design to suit leading and trailing cank pins of 5" dia.	}	WP	Connect with Mod: WL.5.019 For new builds only.
EQ.3.039	9 . 13	Electric conduit inside the 'bullet nose' of streamlining to be covered with heat resistance insulation.	;	WP	
FR.2.01	5 15	Frame and frame clips to be modified.	CSO Sk L. 354	WP: WG CSO Sk.L 354 WL: YP: YG.	
FR.2. <b>01</b>	e 41	Wedges and shoes for Leading & trailing wheels to be of modified design to suit axle boxes suitable for 8 3/8 inch axle journal.	0	WP CSL 2286	Connect with Mod: WL.4.012
FR.2.08	33 17	Cattle guard design to b	e	All IRS (B.G.)	

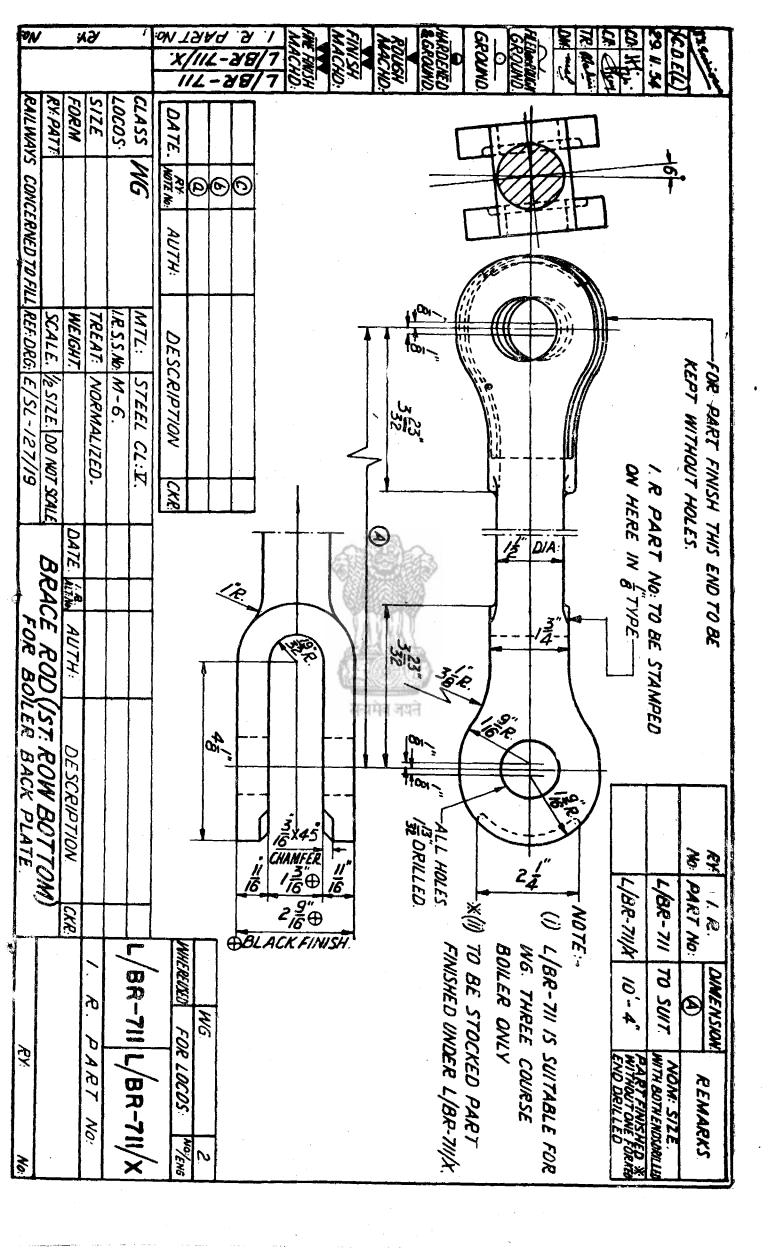
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REPORT OF THE XXXVI LOCOMOTIVE STANDARDS COMMITTEE

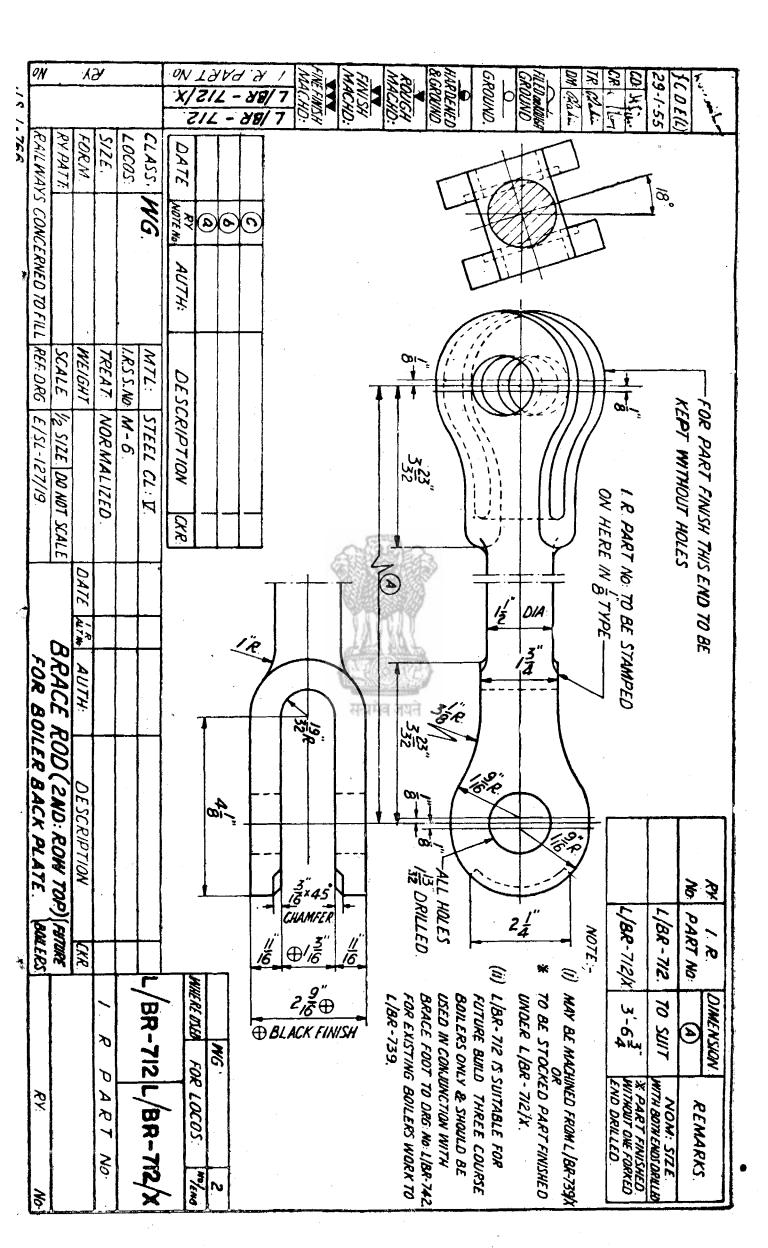
Group Modifi- cation No.	kef. Para of XXXVI LSC	Description of Modification.	Sample Drg.	Loco and Drg. Reference	Remarks
FR.4.034	8	Breather plate at hind end to be strengthened.	CSL 2458 Alt: 2	WP: WG CSL-2458 Alt: 2	Connect with Modifications AN.2.016, 018 and 021
∘GEN.2.024	42	WH. class, 2-8-4 type, Broad gauge Tank Loco. Tentative diagram approved.		WH. CSL 2441 alt: 1	
IR.2.021	20	"Nathan" injector to be replaced by Simplex,.		WP/P  CSL 2416 alt : 1  & 2417 alt 1	
MN.2.015	22	Modified design of motion components.	L/MN 696, 699, 701, 702	L/MN 696, 697, 698, 699.	
		,		L/MN 696 698, 701, 702	
MN.4.014	23	TIMKEN roller bearings to be provided on crank end of eccentric rod.		All IRS Locos	To be standard pending experience with direct mounted SKF roller bearings.
PK.2.008	26	Swab boxes of fabricated design to be standard.	CSL 2468	All IRS Locos.	
		6		CSL 2468	•
RG.2,018	29	Revised design of regulator creep prevention device to be provisional Standard for new Locos.	WRIy LGB 1843	All IRS Locos	Provisional
SN 3.028	30	Front transverse beam stren- gthened		WG. CSL 2020 alt: 2	
~SN.3.035	35	Revised design of compensating beam for tender bogies.	सद्यमेव जय	WP: WG. CSL 2330 alt: 3	Connect with Mod: SN.3.039 & TE 2.021
SN.3.037	30	Strengthened designs of coupled compensating beams.		WG CSL 2447 ait: 1	
SN,3.038	31	Revised design of fulerum point suspension for compensating beam front between truck & leading coupled wheels.		WG. CSL 2381 alt: 1	CSL 2381 supersedes CSL 2054 sheet 1.
SN.3.039 TE.2.021	35	Modified design of tender bearing spring safety straps		WP: WG: WP/P CSO Sk.L.358 alt: 3	Connect with Mod: SN.3.035
S.N.3.040	32	Roller type pintles to be provided on compensating beams between coupled wheels.	CSO Sk. L-90	WP, CSO Sk.L-90 YP.	
SN.4.006	32	Auxiliary springs in form of "Bellevill" washers to be provided in coupled spring hangers.	CSL-1989 alt: 1	WP CSL-1989 alt: 1 YP.	
:SX <b>.8.0</b> 08	7(vii)	Spark arrestor nettings in smoke-box to be re-arranged for easy handling.	E/SL131/ 50, 51	WP:WG:YP:YG	

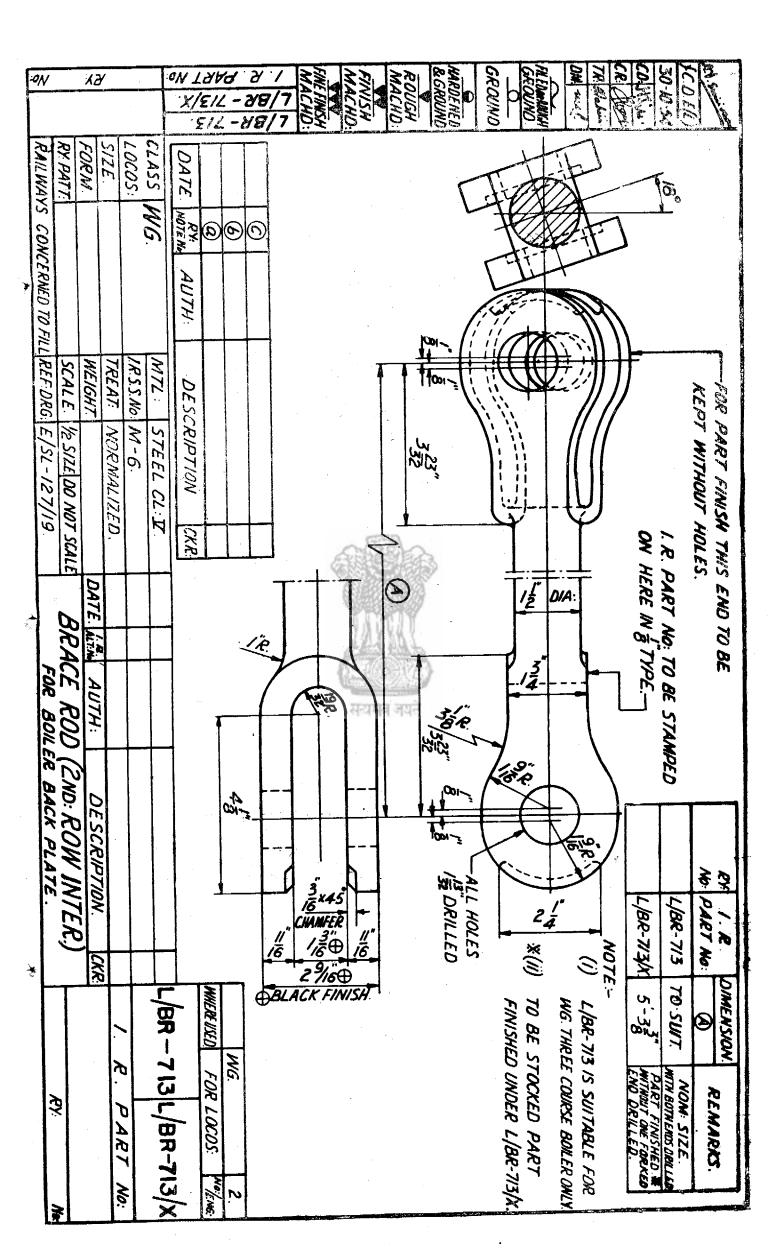
Group Modi- fication No.	Ref. Para of XXXVI LSC.	Description of Modification	Sample Drg.	Loco and Drg. No.	REMARKS
SX.5.016	33	M.V.R. header with values on superheat side to be used on renewal boilers originally fitted with this type of header.		IRS locos originally fitted with M.V.R. header.	
TE.2.022	34(i)	Modification to fabricated tender bogie transom.		WG. CSO Sk, L-368 alt: 1.	
TY.2.012	36	Provision of rivet fastenting of tyres on coupled wheels of existing Locos.		WP CSL 2479 alt: 1, 2480 alt: 1	Optional.
WL.2.02	38(i) 38(ii)	Material of wheel hub liners to be standard:—11 to 14% mangane:e steel halves sec- ured by copper setscrews.	CSL 2512	All 1RS Locos WP WG  CSL 2512 C5 L2511	
		Permissible alternative for indigeneous manufacture:— Cast iron in halves secured by copper set secrew.		WM YP, YG  CSL 2502 CSL alt: 1 2510	
WL.2.025	38 (iii)	Lubrication of hub liners to be by soft grease charged through two grease nipples fitted on wheel hub.	C-L 2453	All IRS Locos.  WG WM  CSL CSL 2502 Alt:1	
WL.2,026	38(iii)	Circular grooves, connecting the grease feed holes to be provided on wheel centres behind hub liners.	CSL 2511	All IRS Locos (B & M.G.)  WG WP  CSL CSL 2512 2512 WM YP:YG  CSL CSL 2502 2510 Alt:1	
WL.2.02	41	Leading and trailing coupled wheel centres and hub liners to be modified to suit 8.8/3" axle journal diameter.		WP. CSL 2512	
SL.4.01	2 41	Leading and trailing coupled axle to have 8.8/3" diameter journal.	CSL 2284	WP. CSL 2284	Connect modifications AB.2.064,FR 2.016,WL,2.027
WL.5.0	19 ) <sub>68</sub> a	Leading and trailing crank pin dia, to be 5 inches		WP CSO Sk.L.360 alt:1	For new Locos only, Connect with Mod.CR 2.041. For existing Locos see Mod:WL.5.021
WL 5.0	20 39(d	diametically across where lubrication is through crank pins and spaced 1/2" from	L-360 alt:1	CSO Sk. L-360 WG, YP, YG,	
WL.5.0	21 39 <sub>1</sub> b	centre line.	:	WP For all locos L/WL 633, 634, 635, 686 & 632 alt: 1	old see Mod: WL.5.019 new

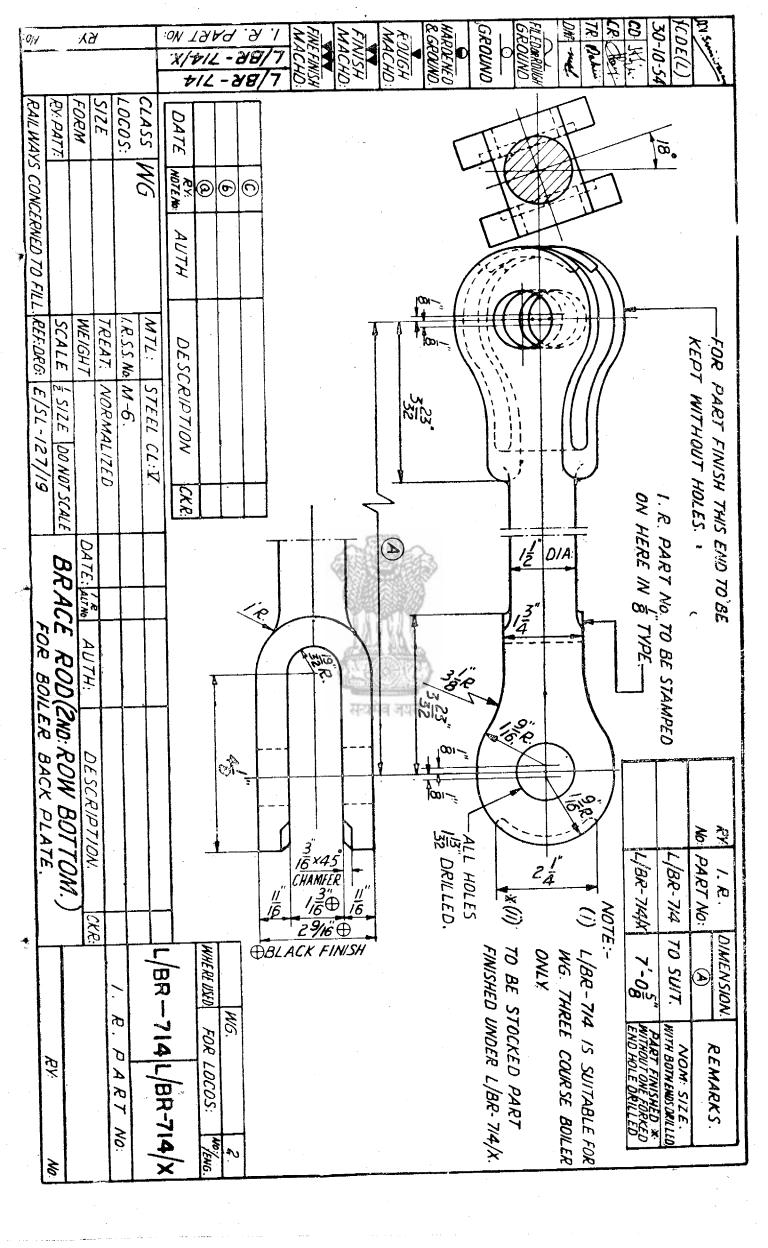


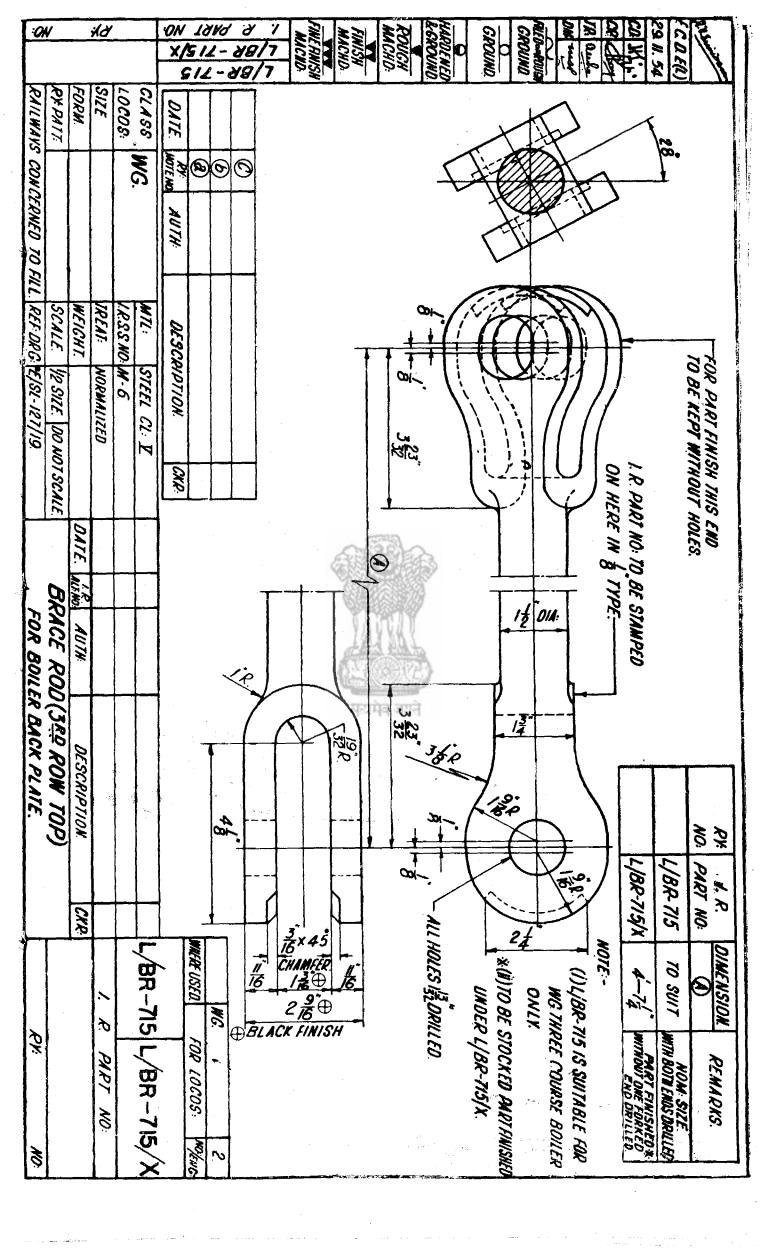


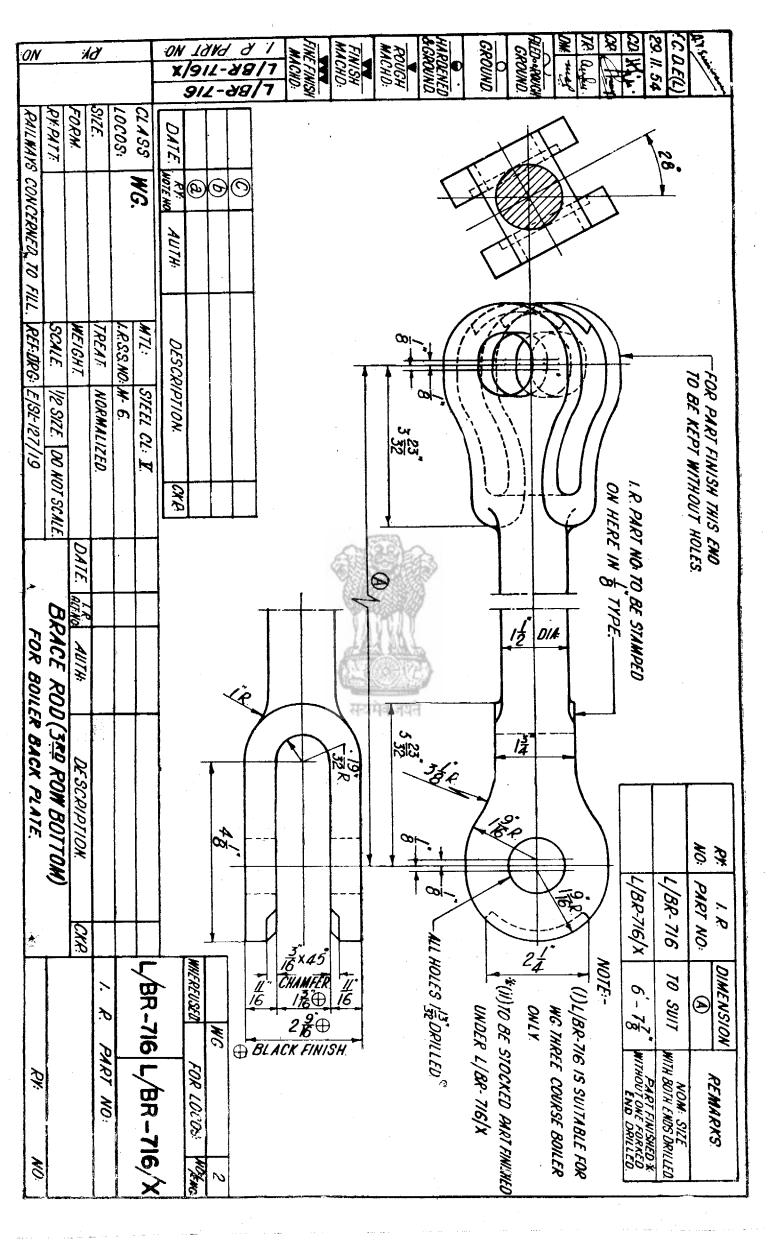


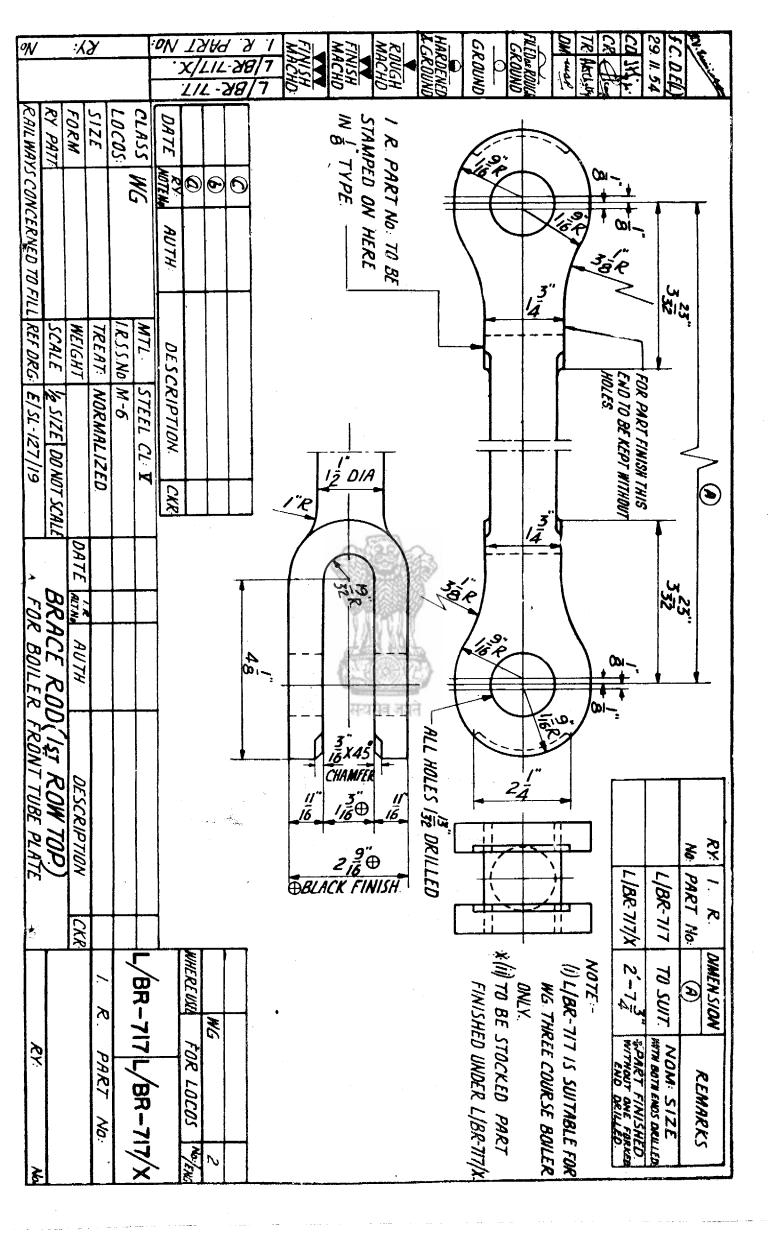


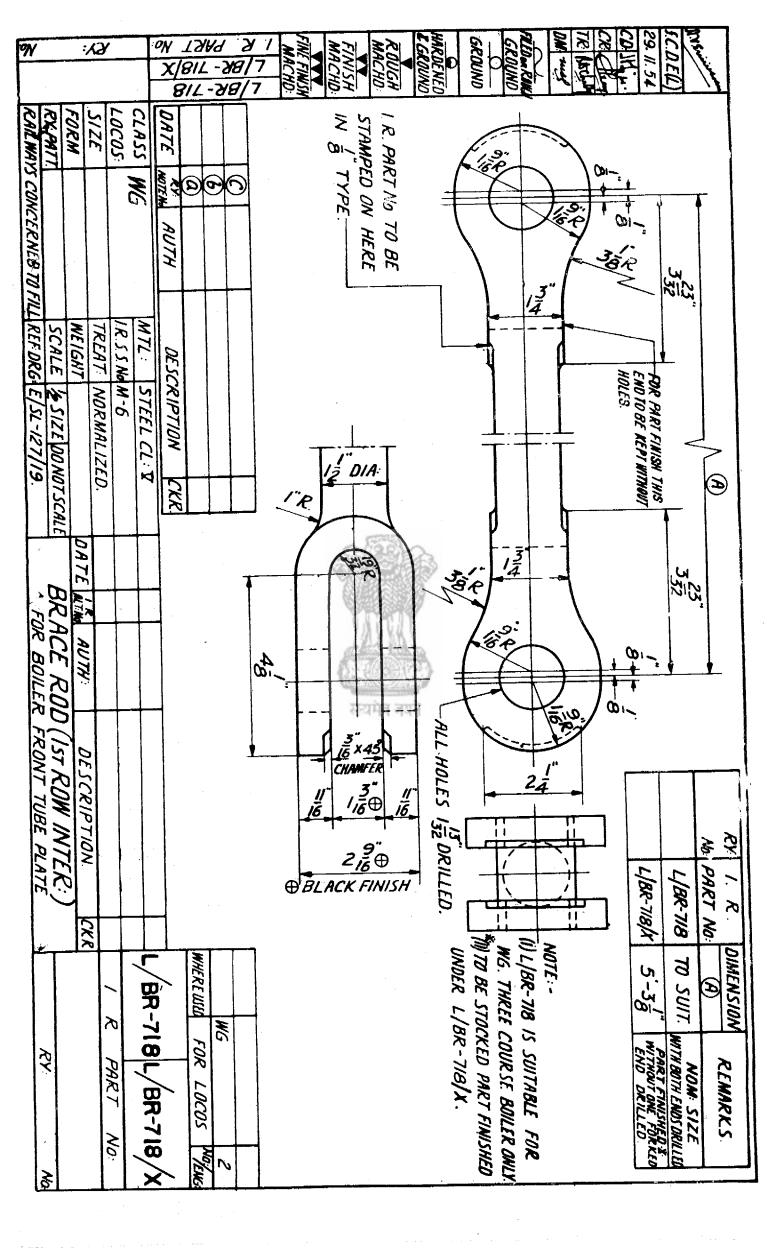


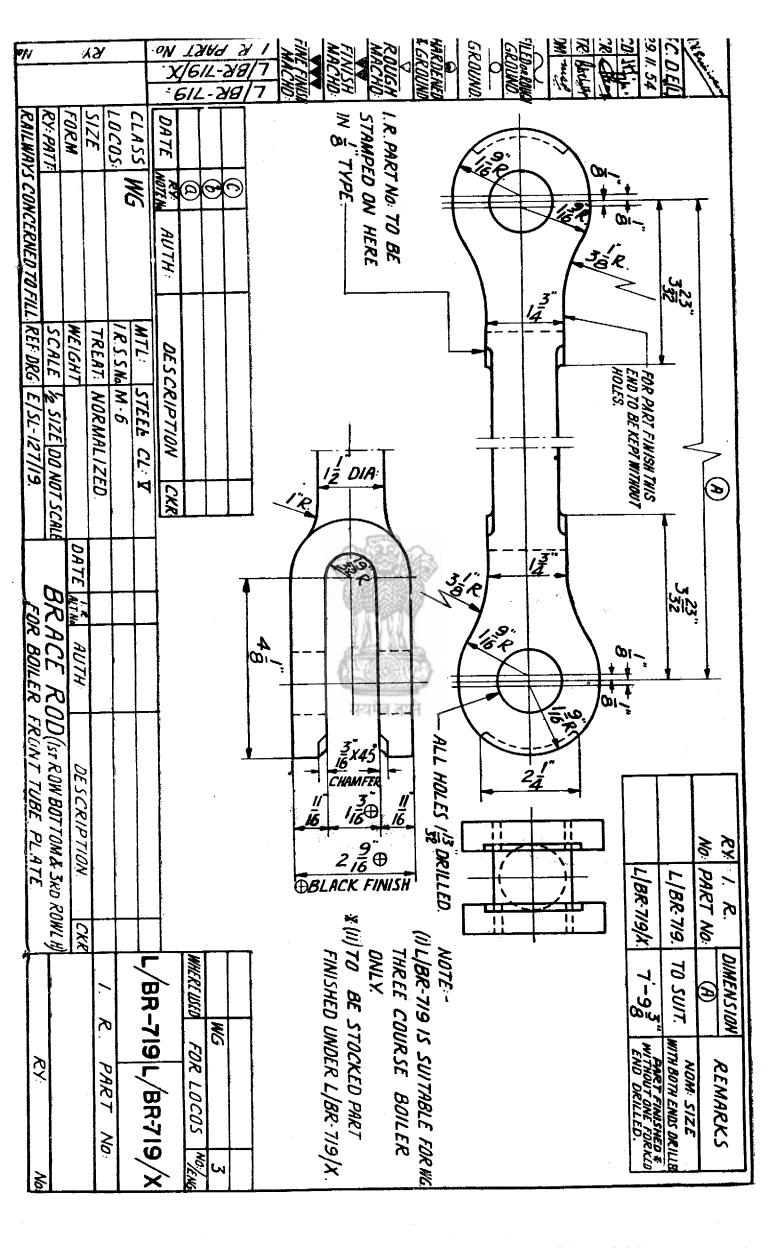


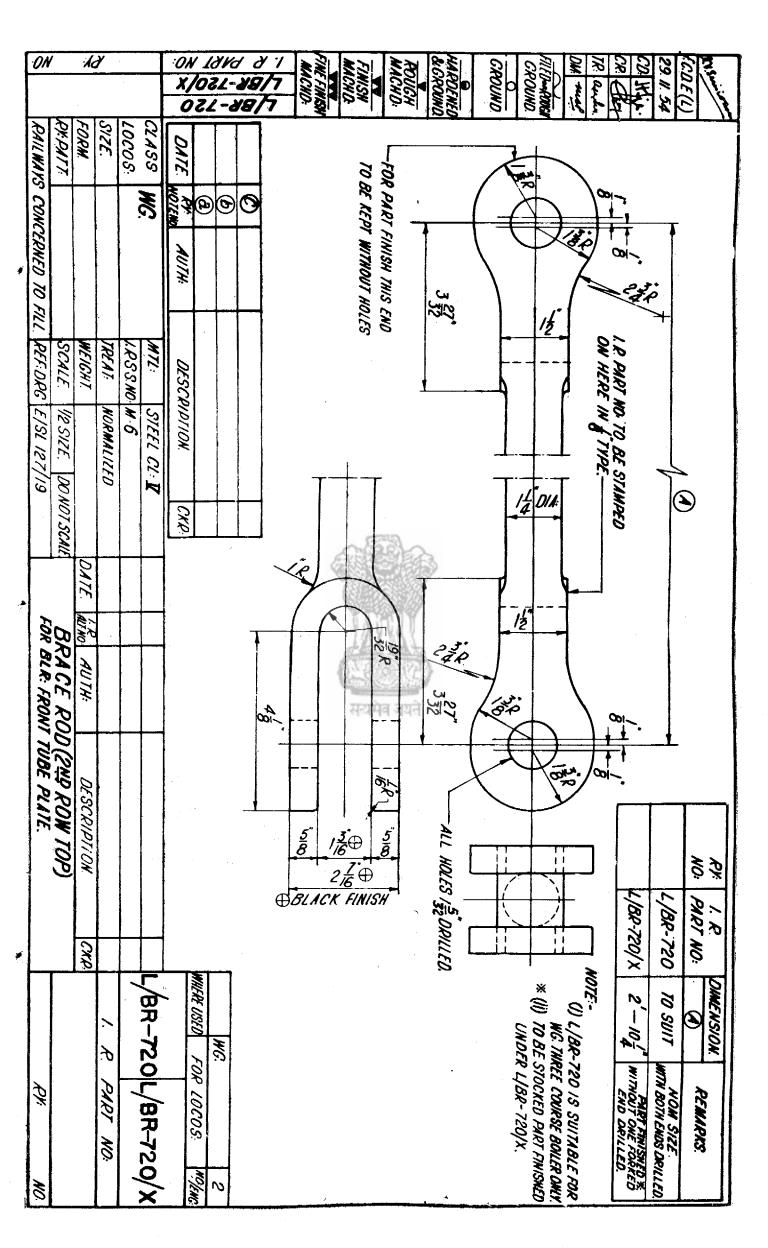


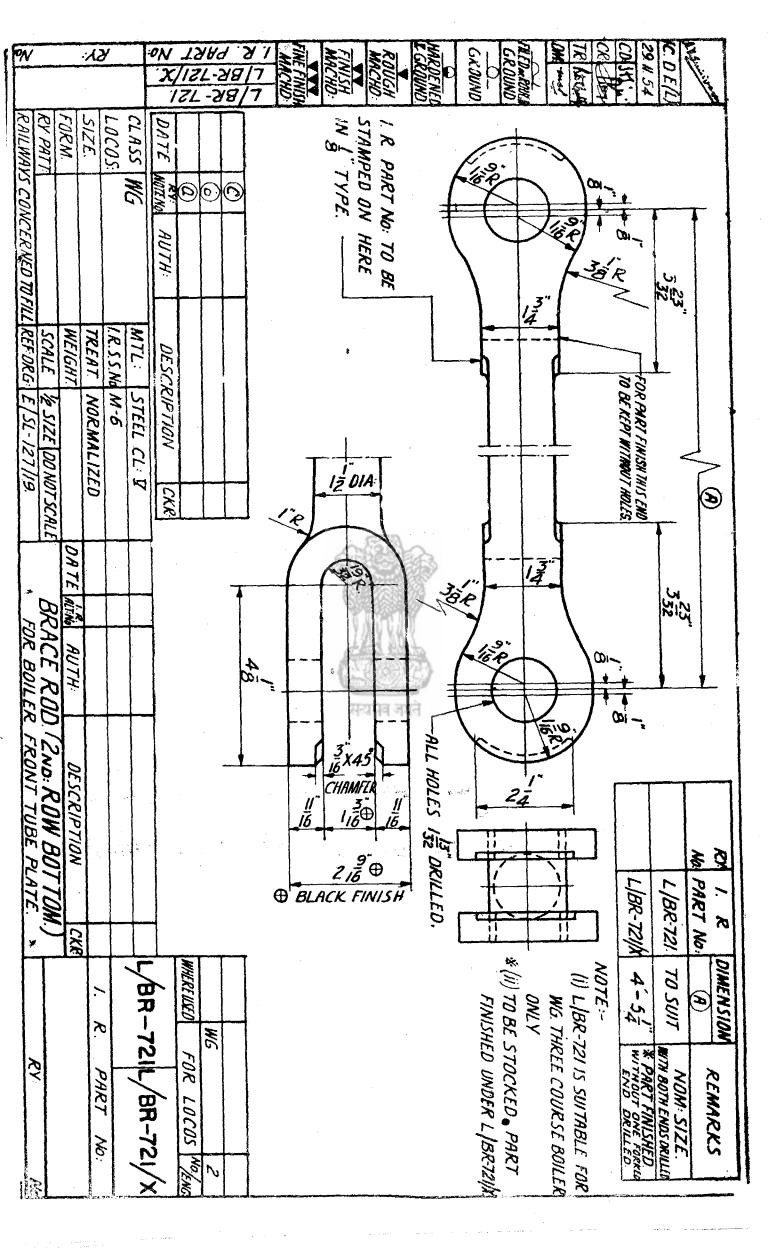


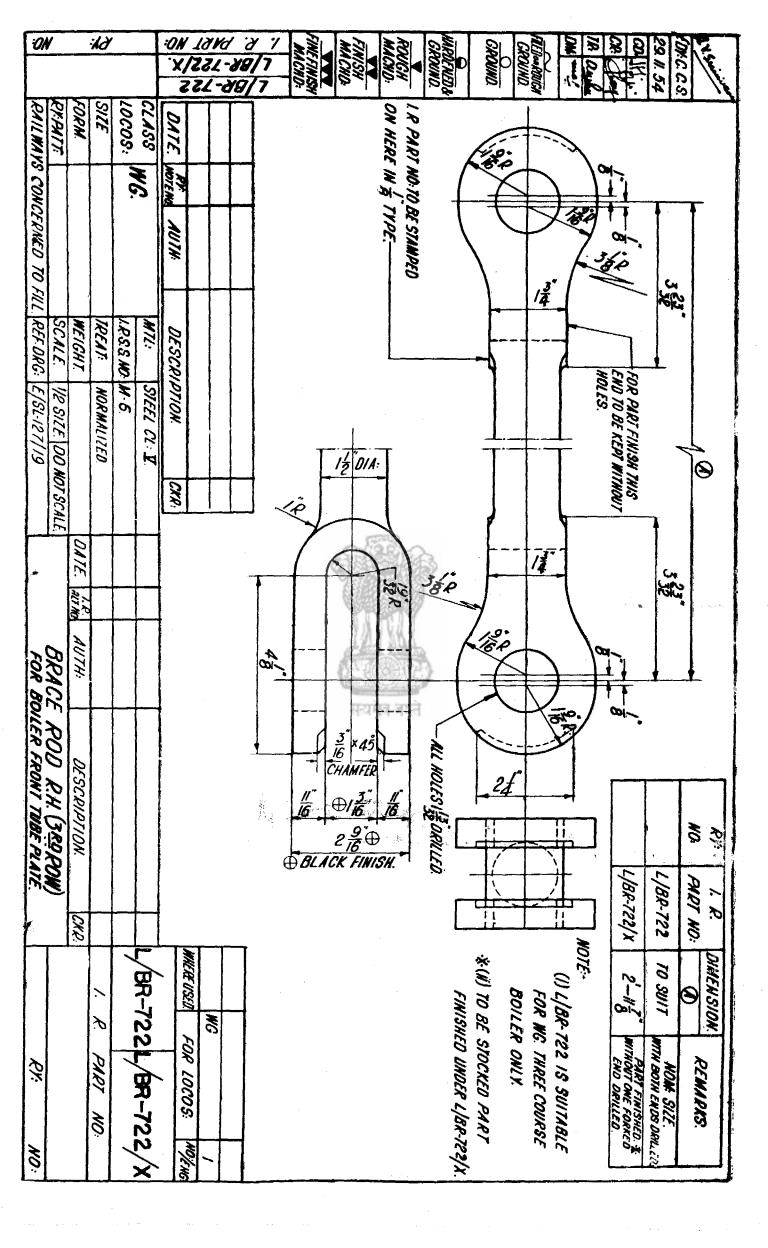


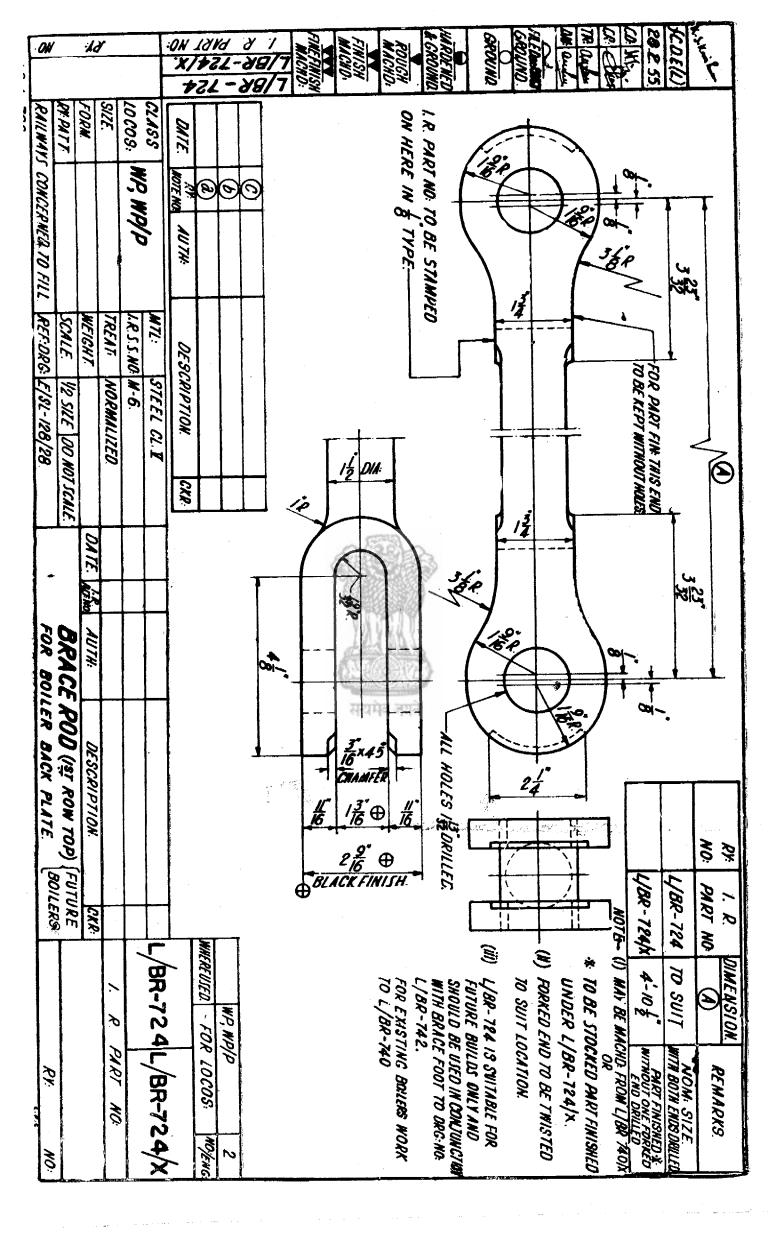


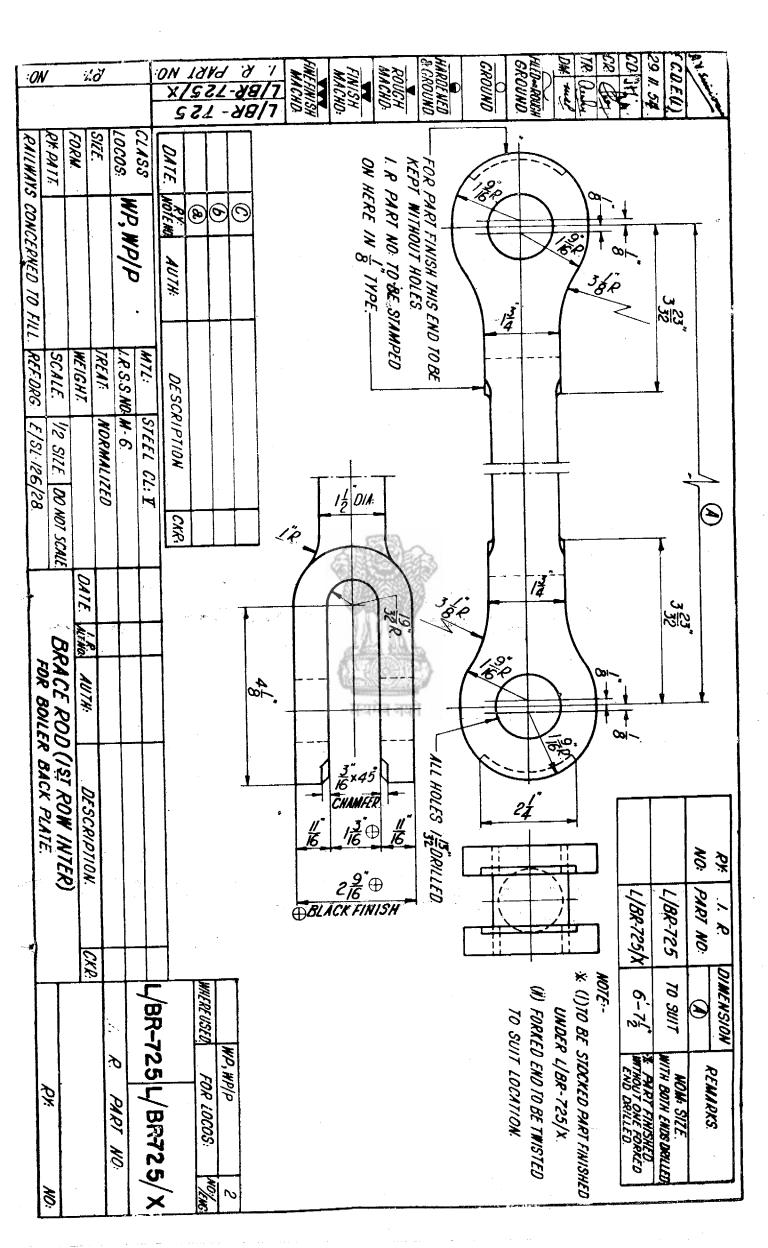


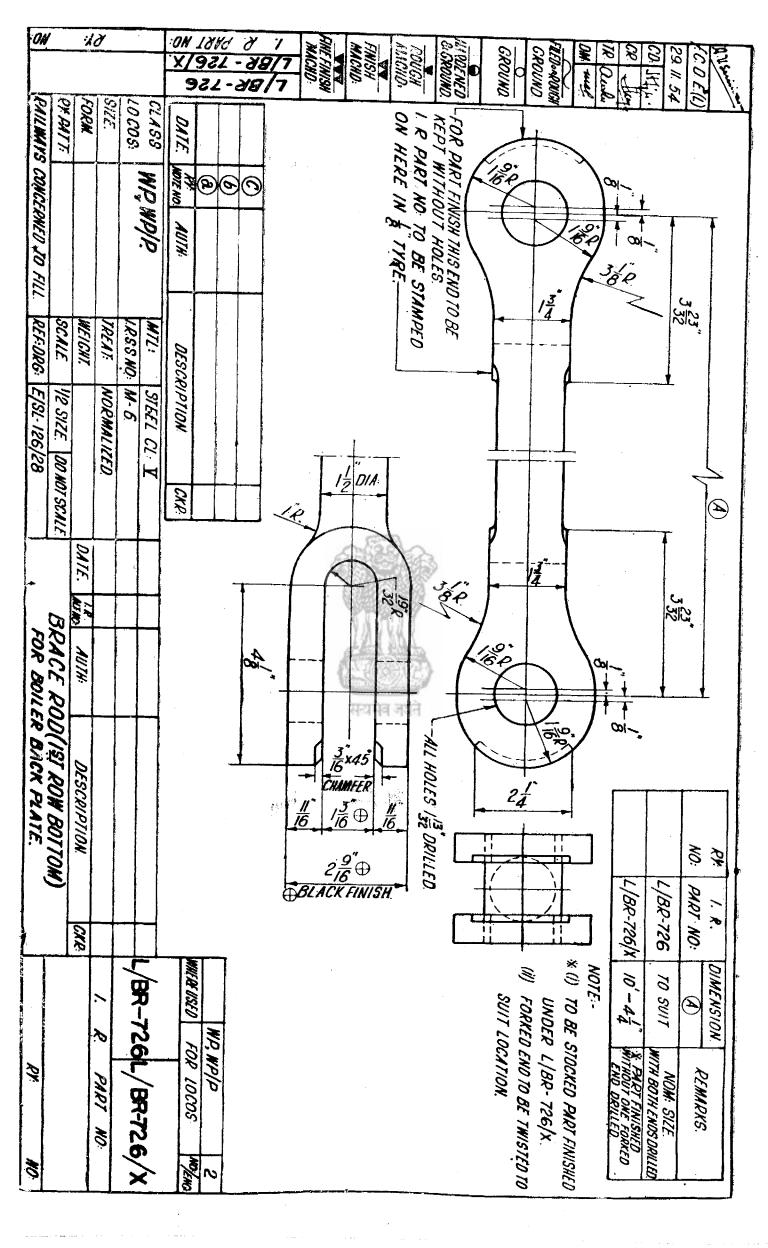


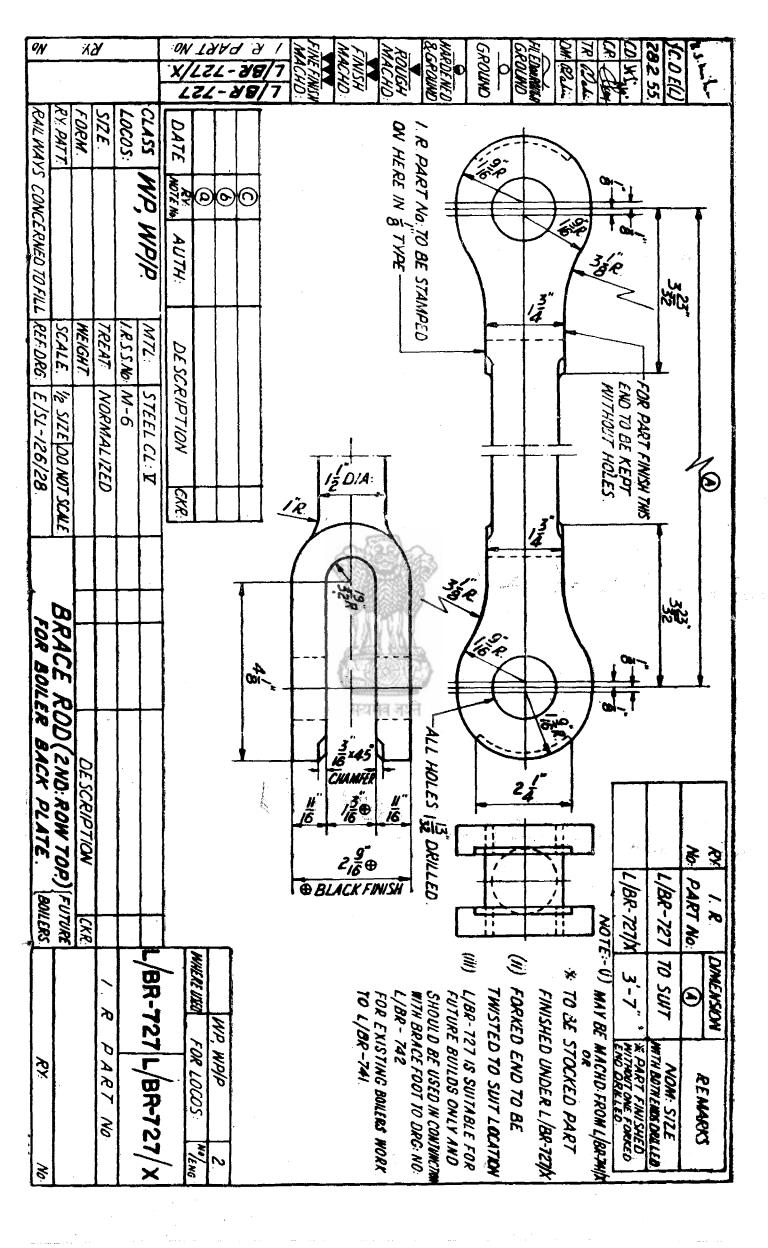


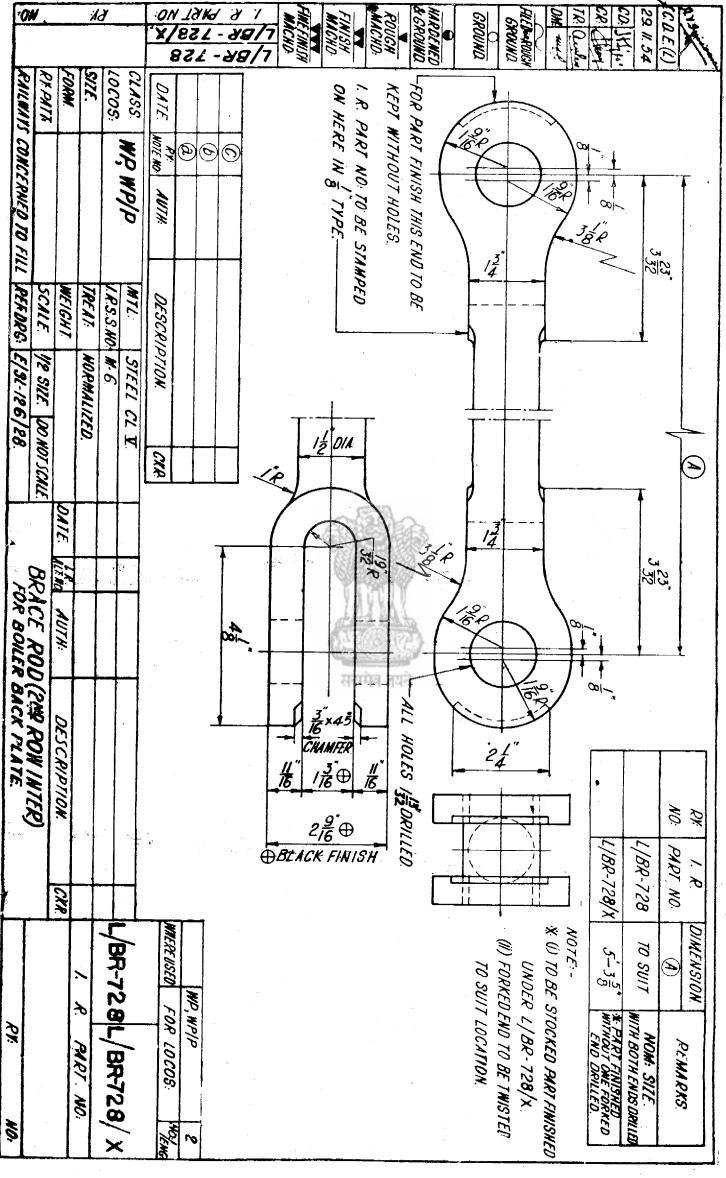


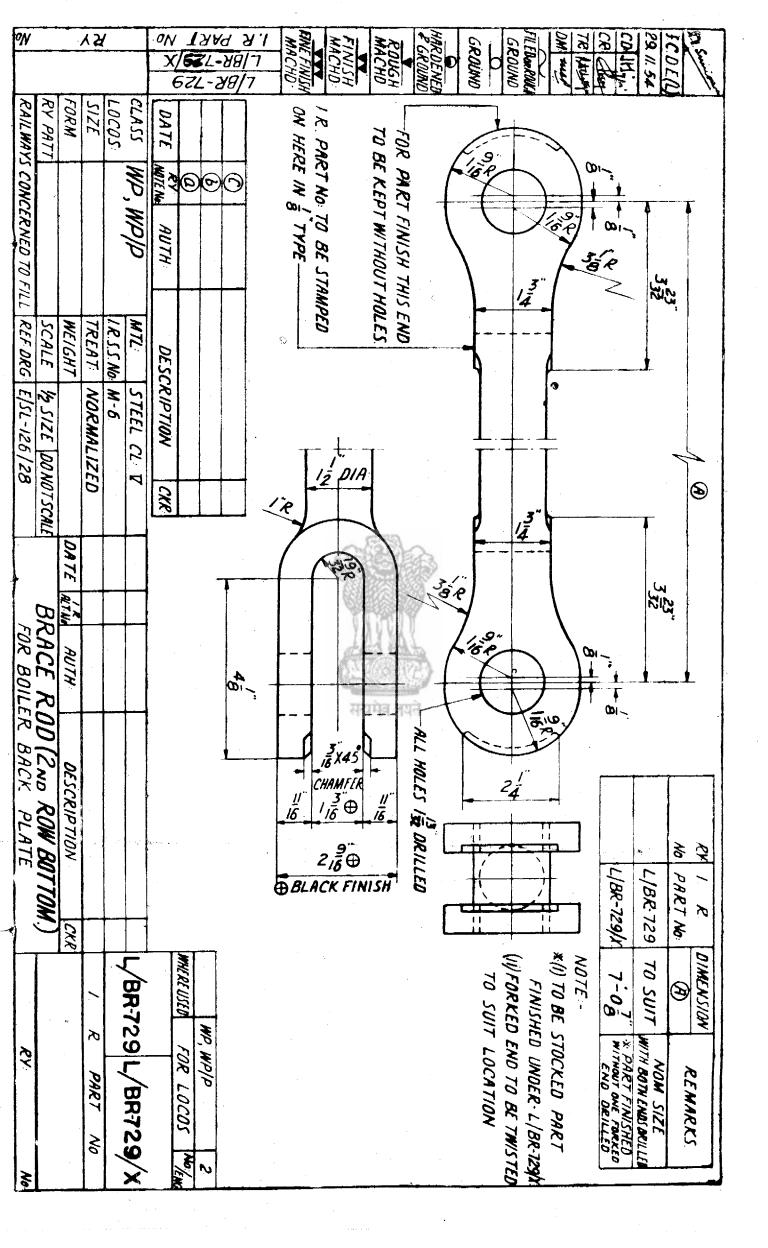


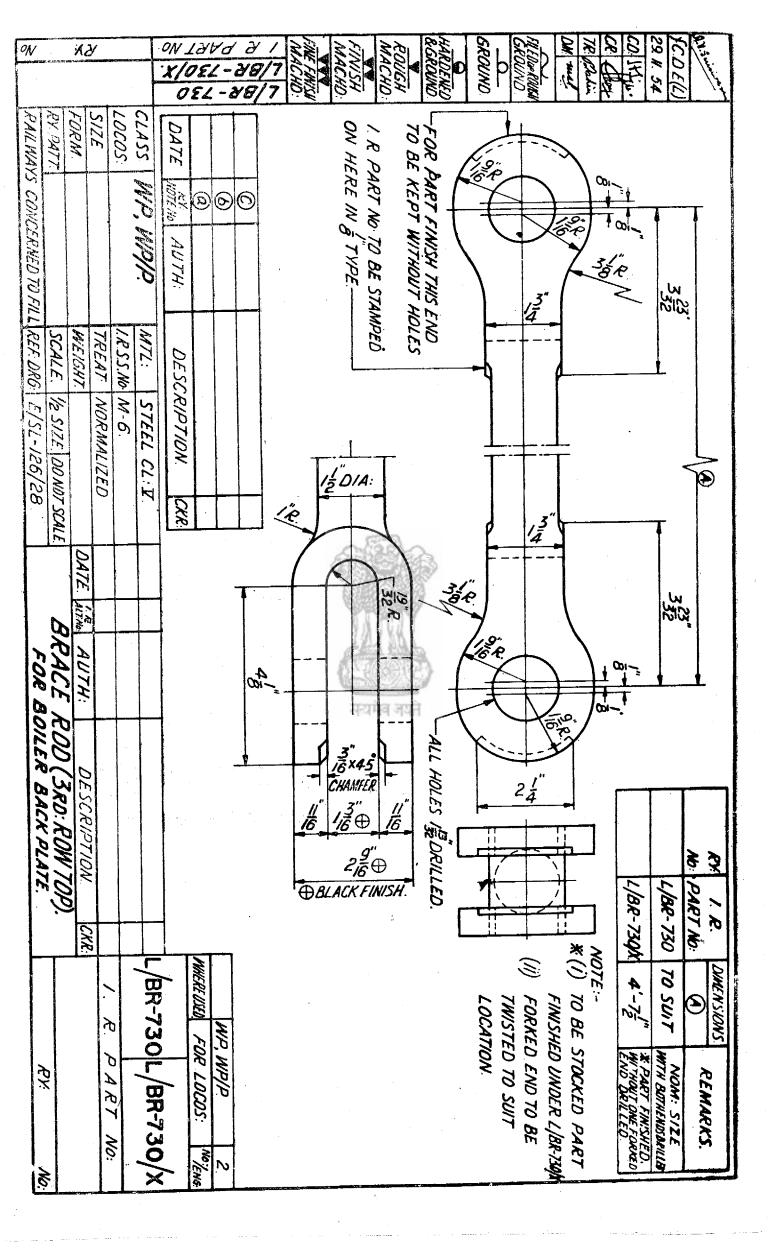


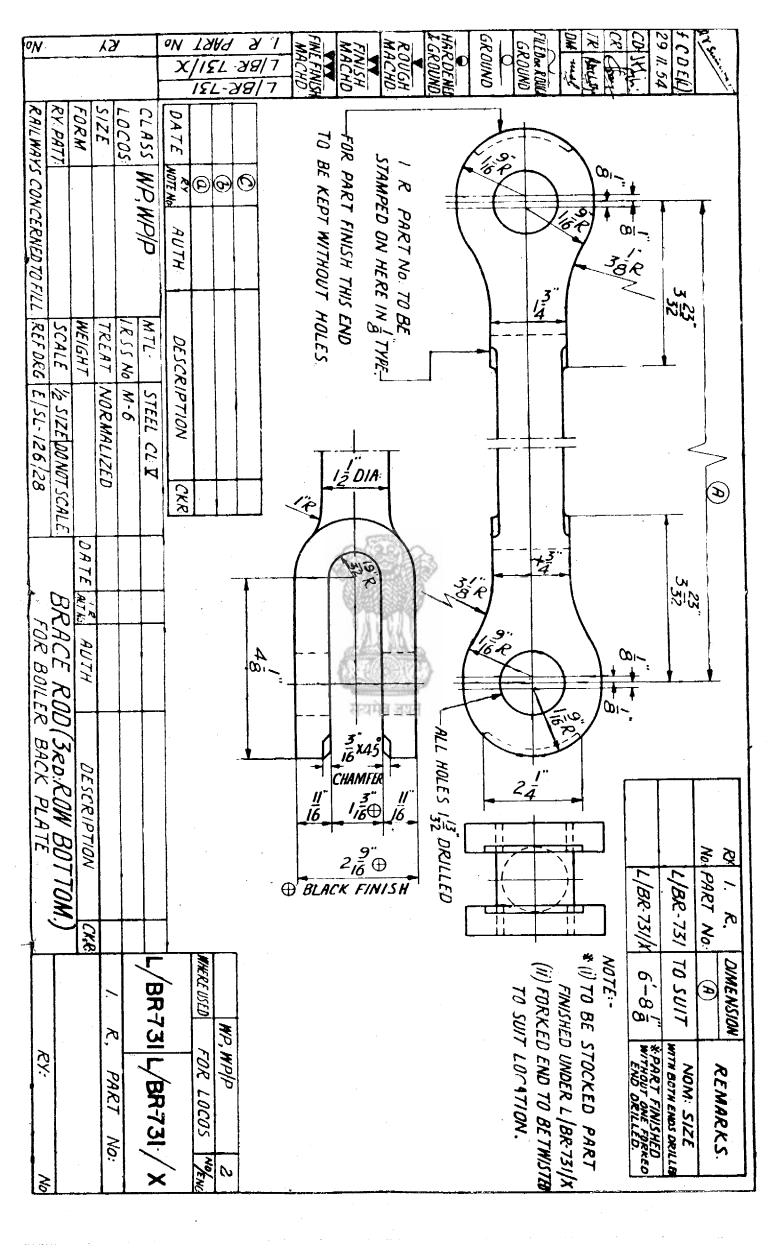


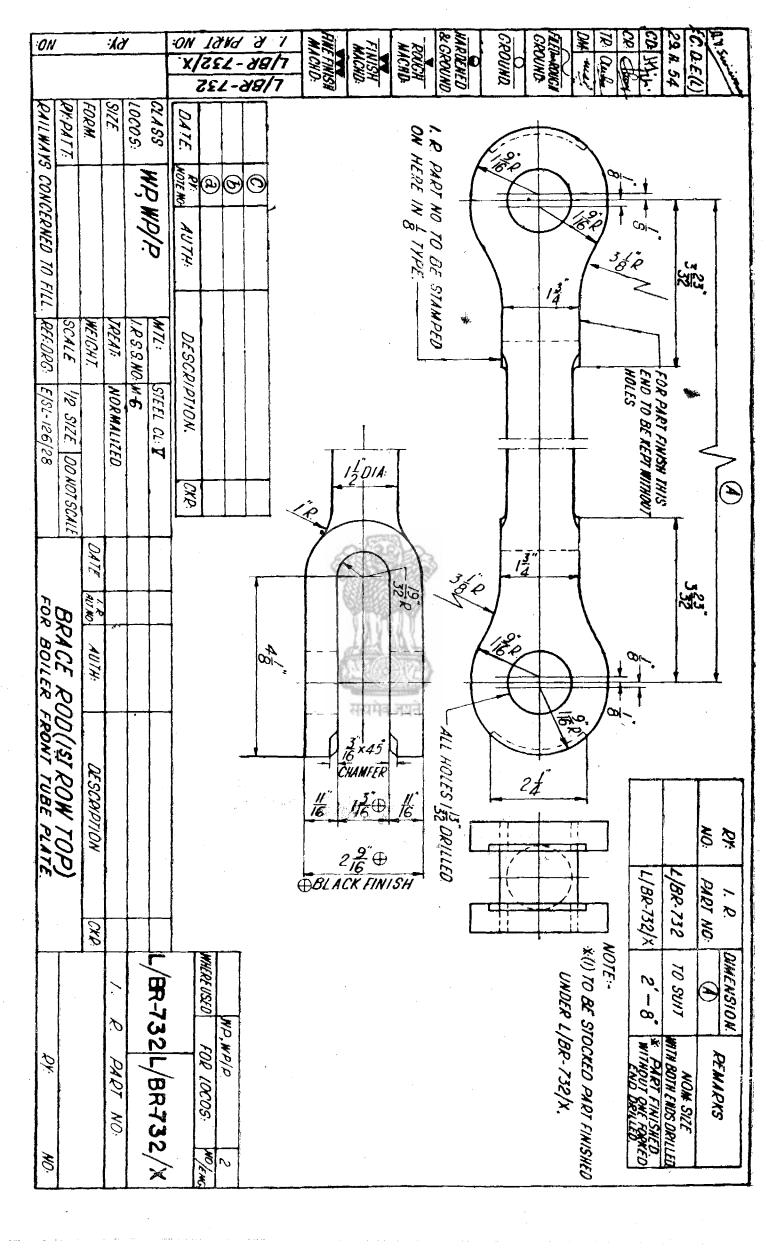


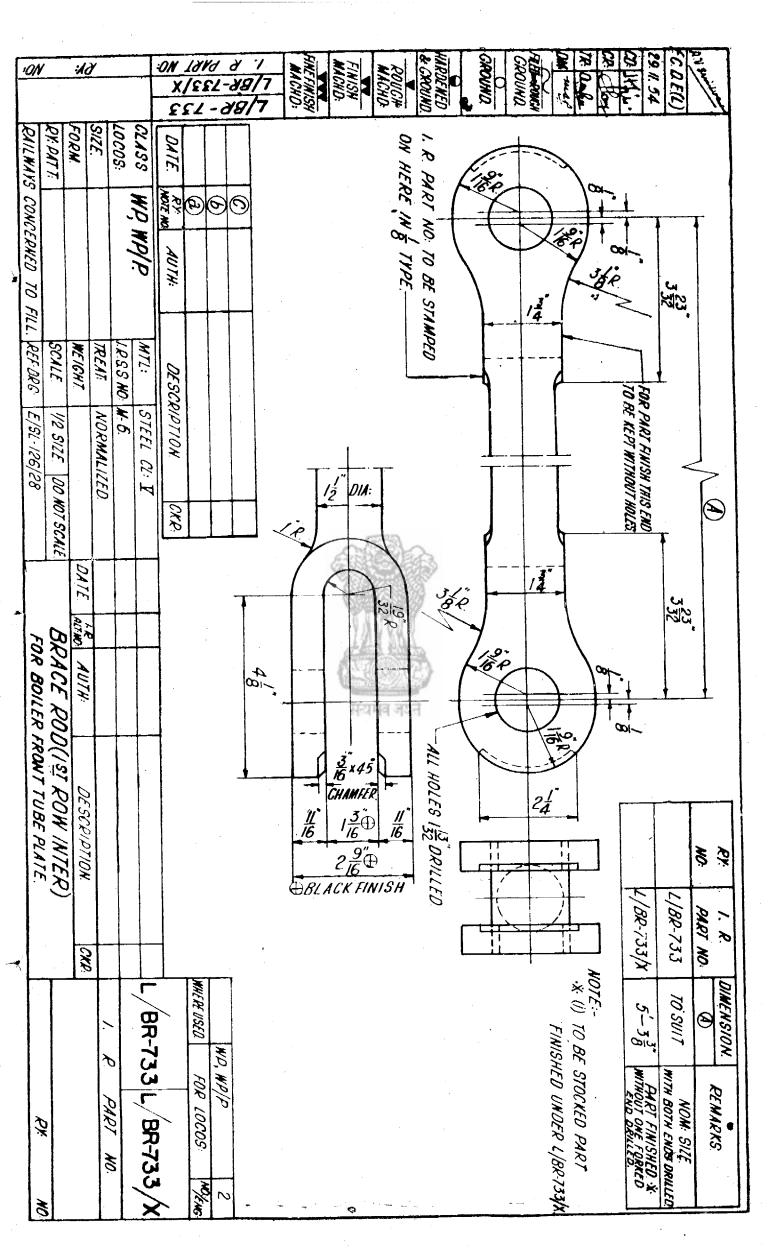


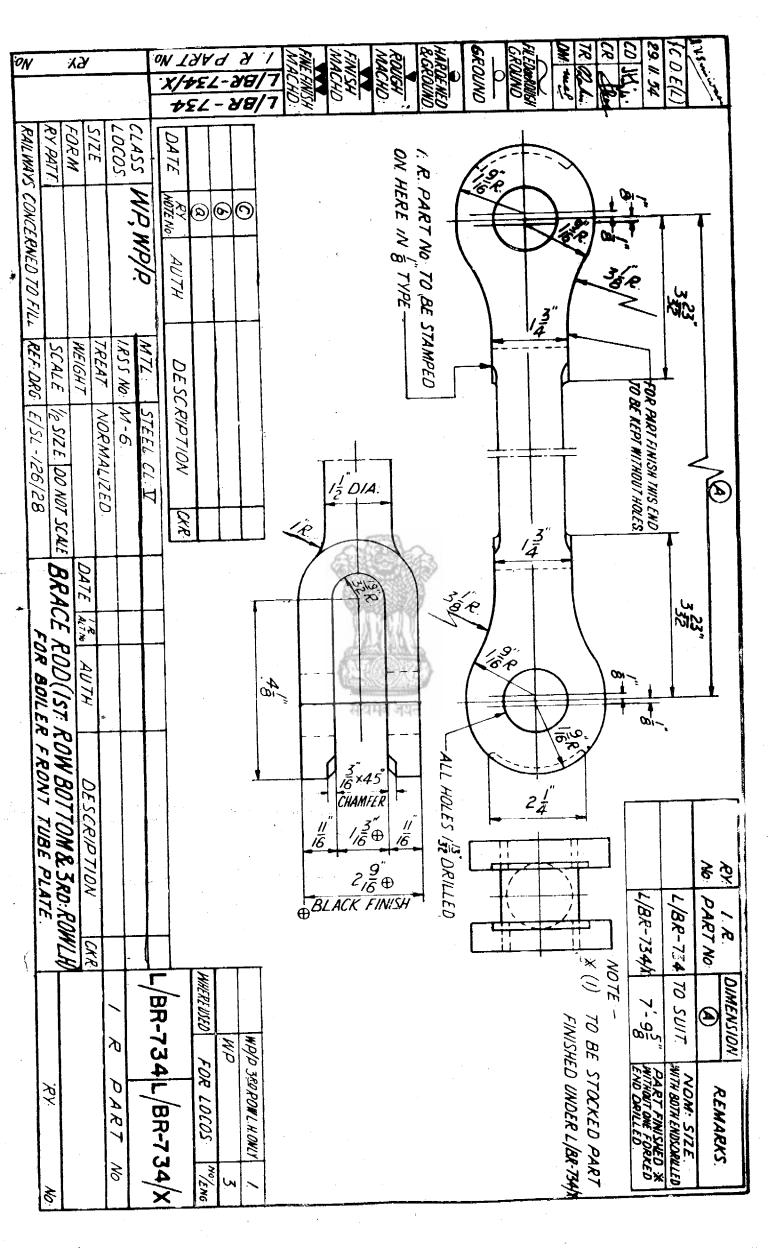


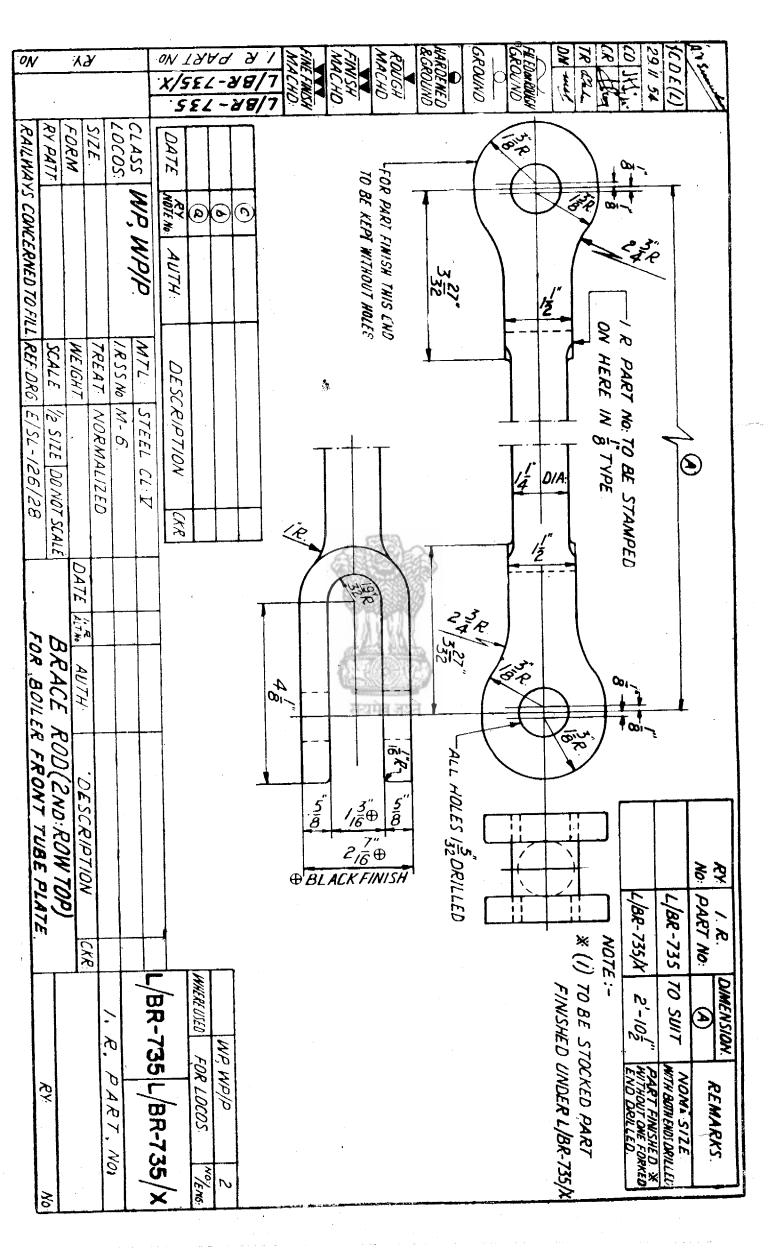


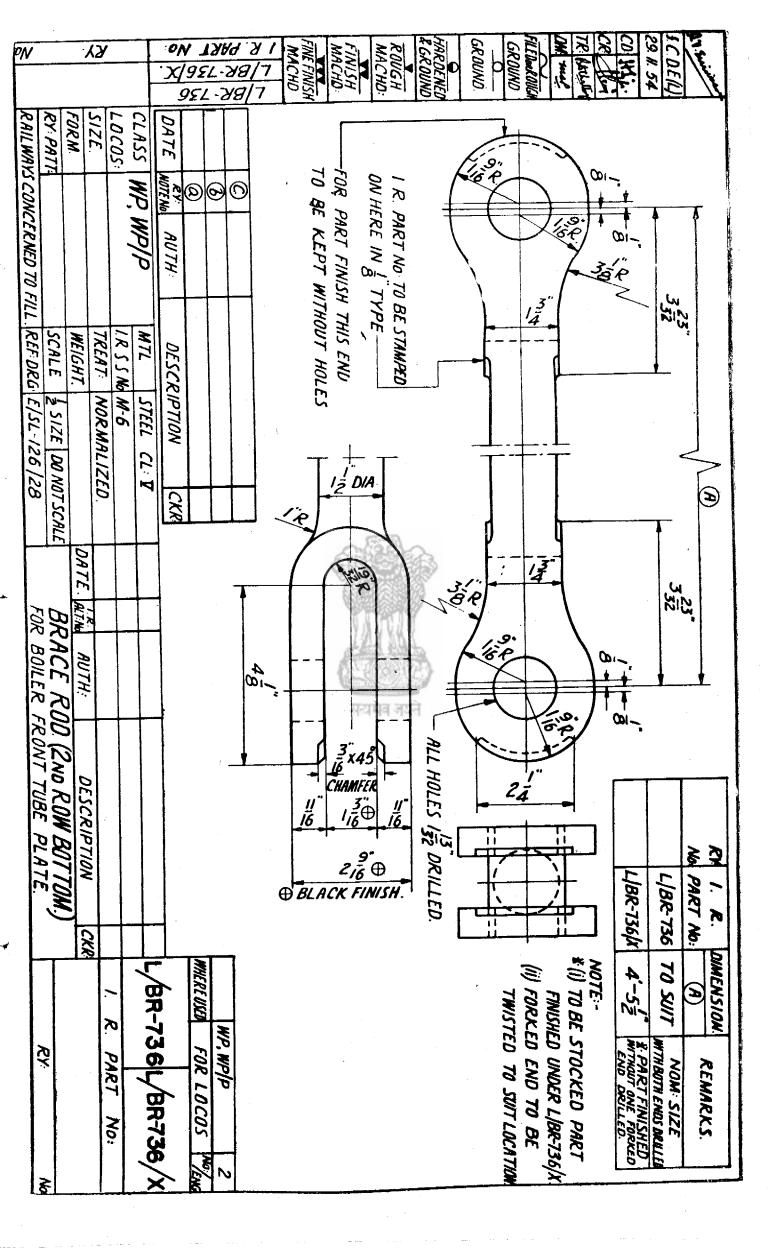


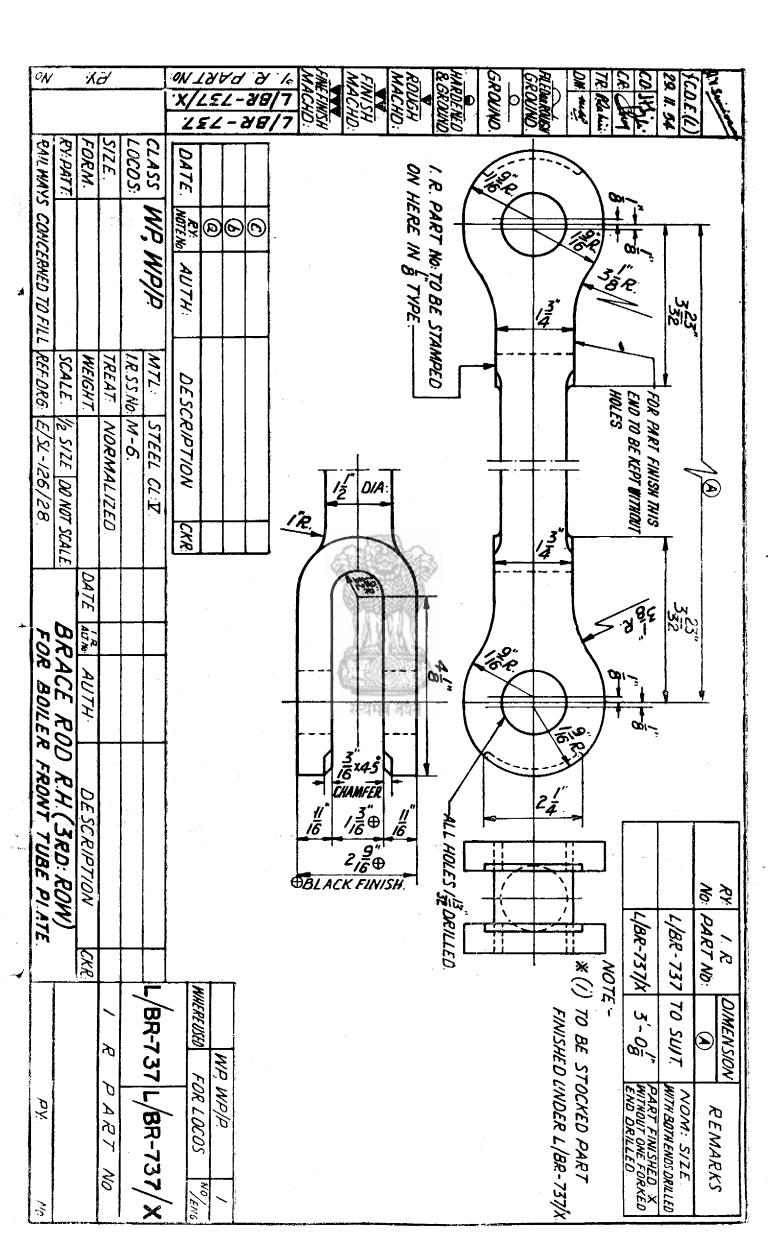


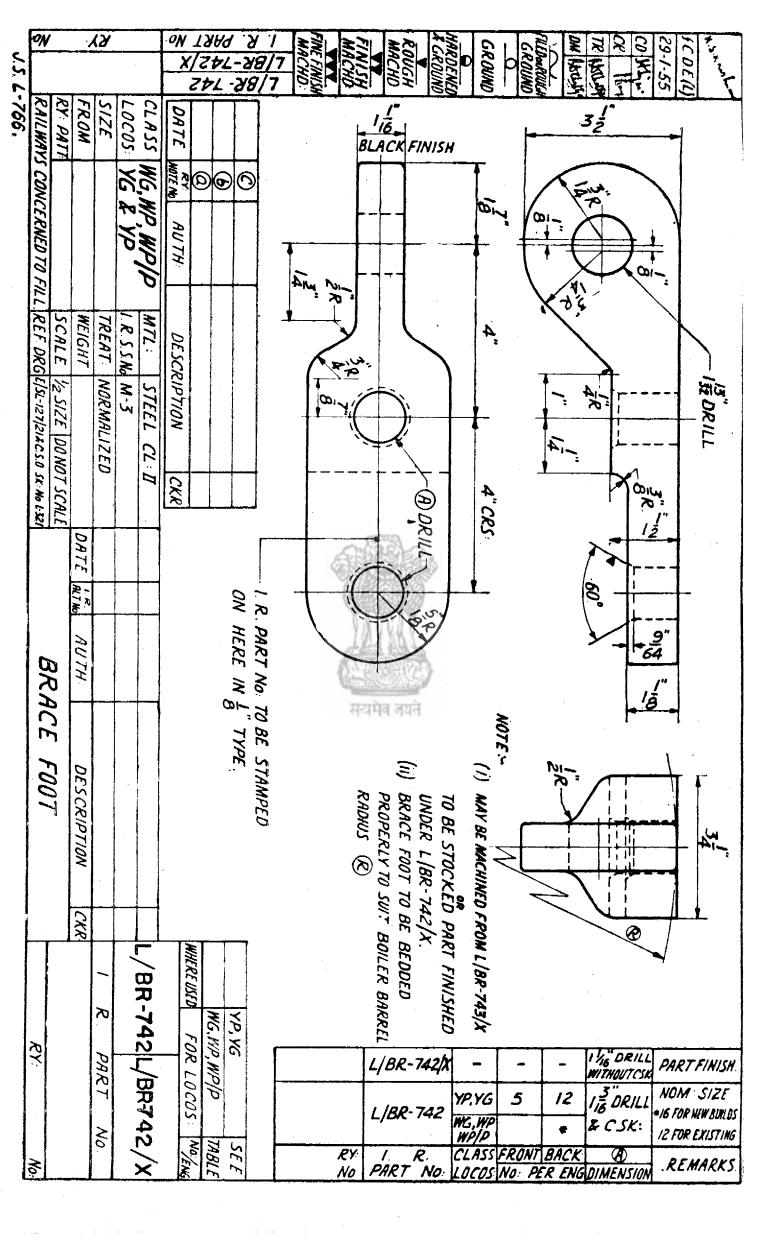


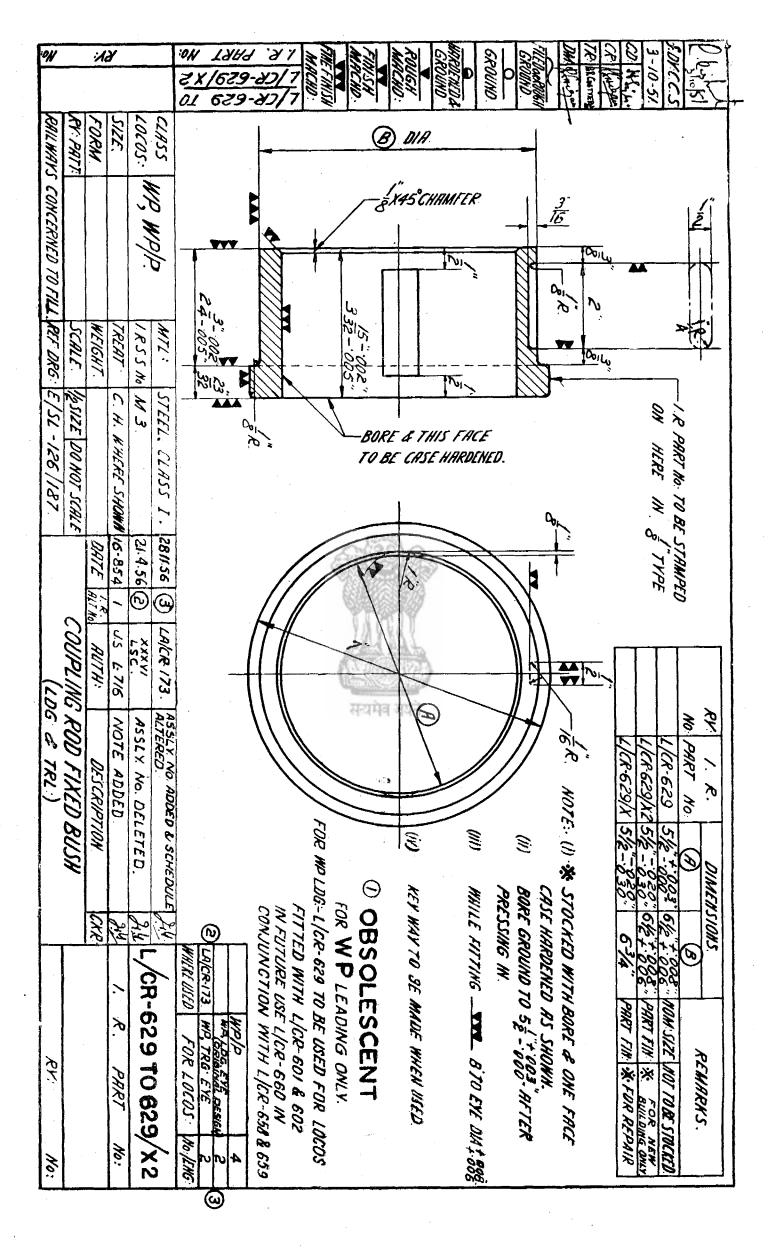


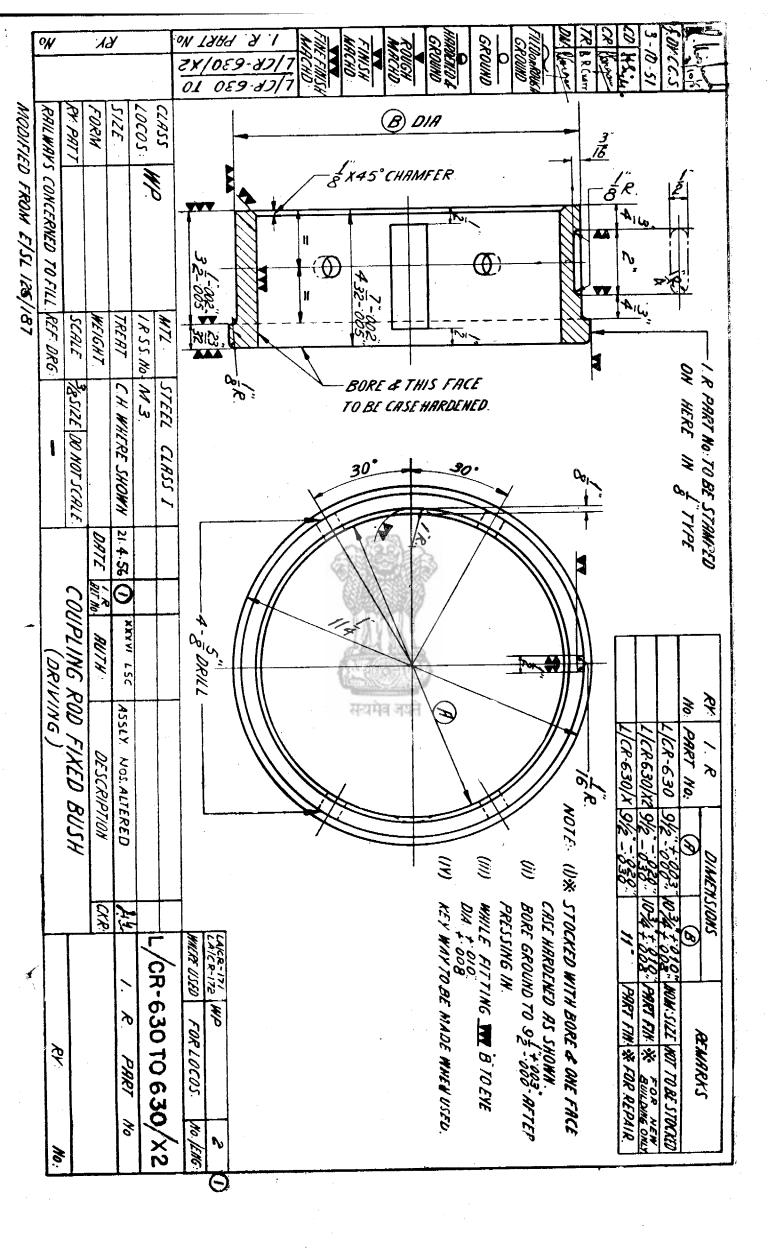


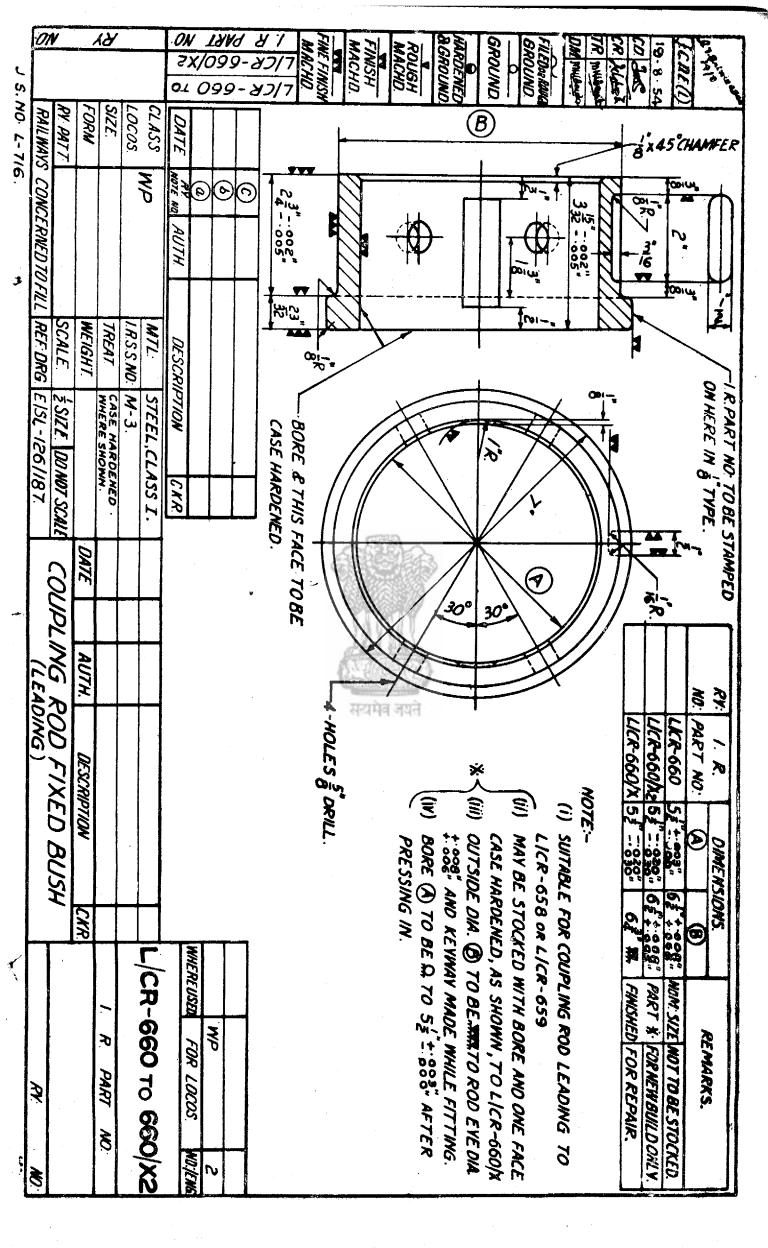


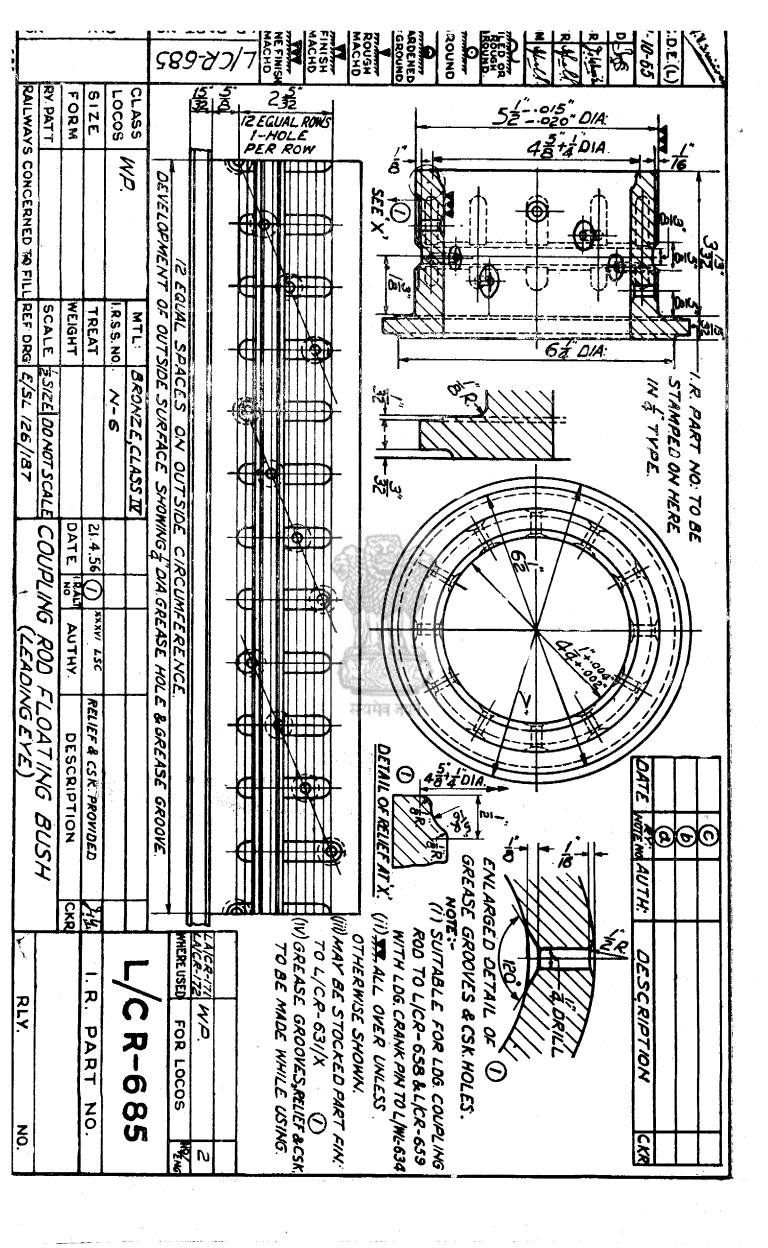


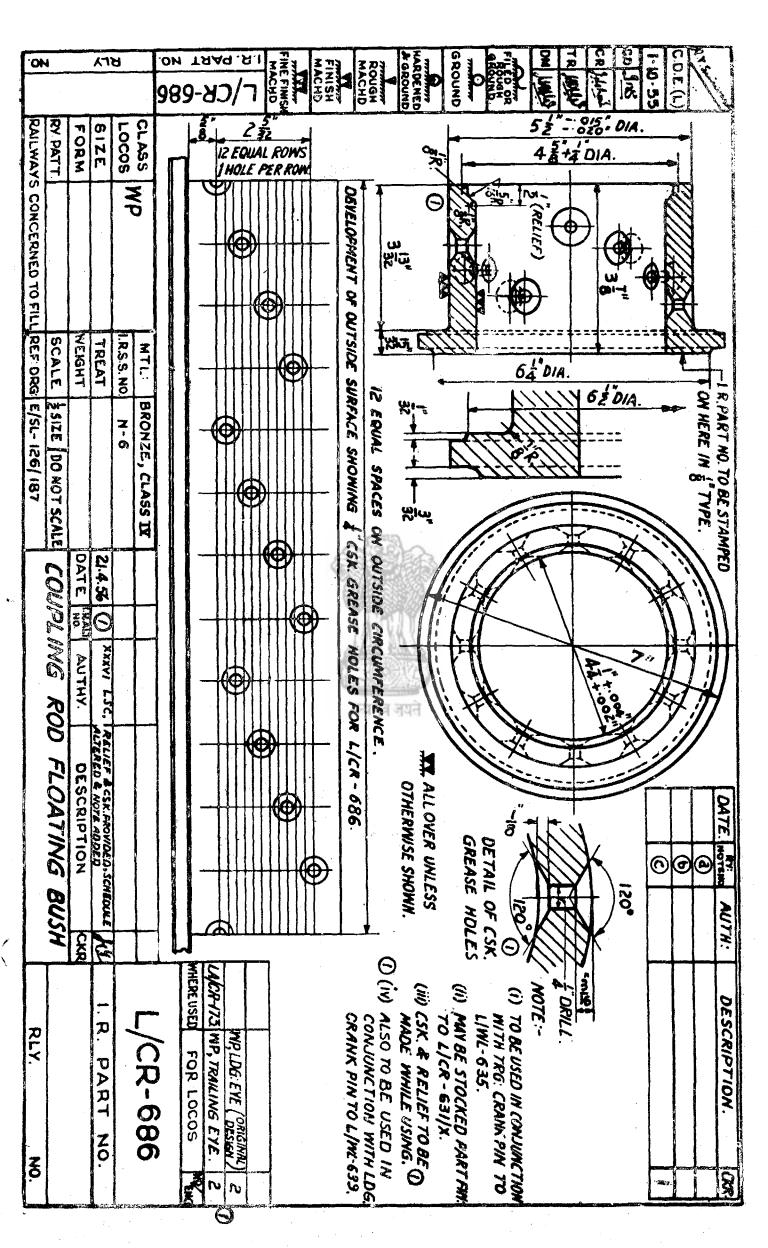


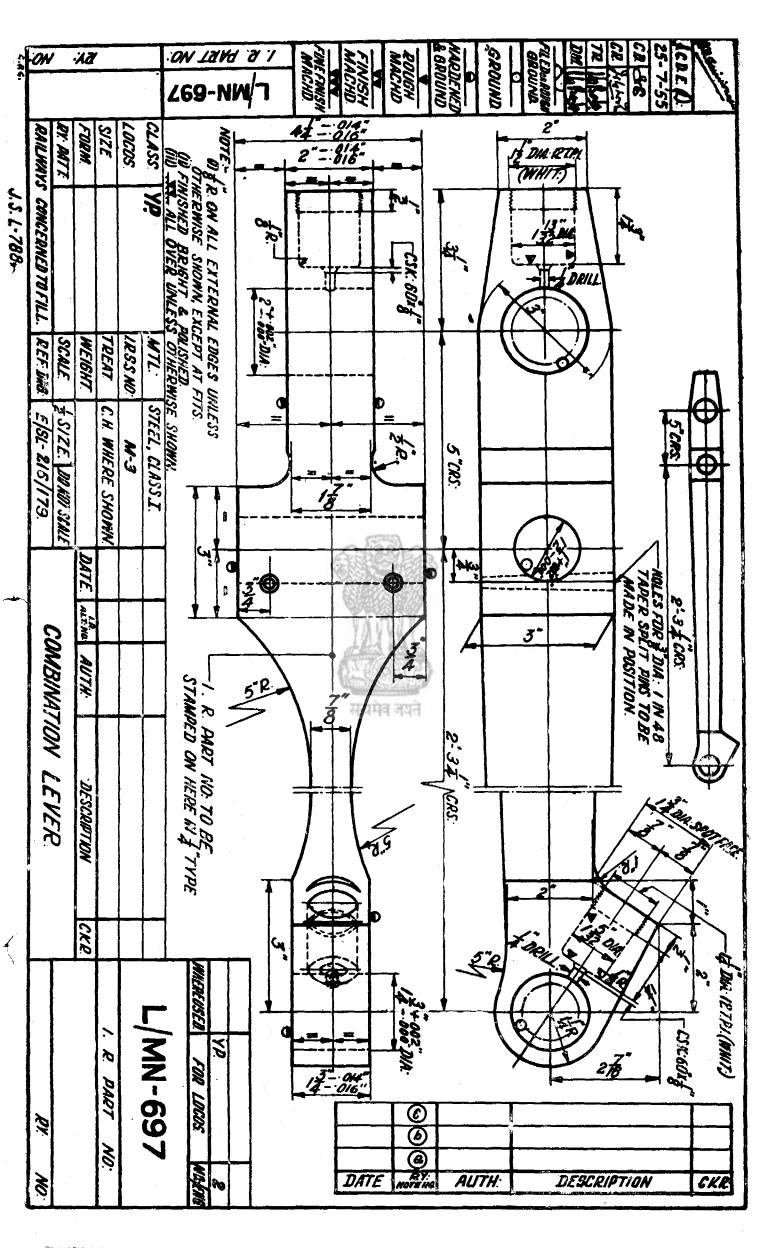


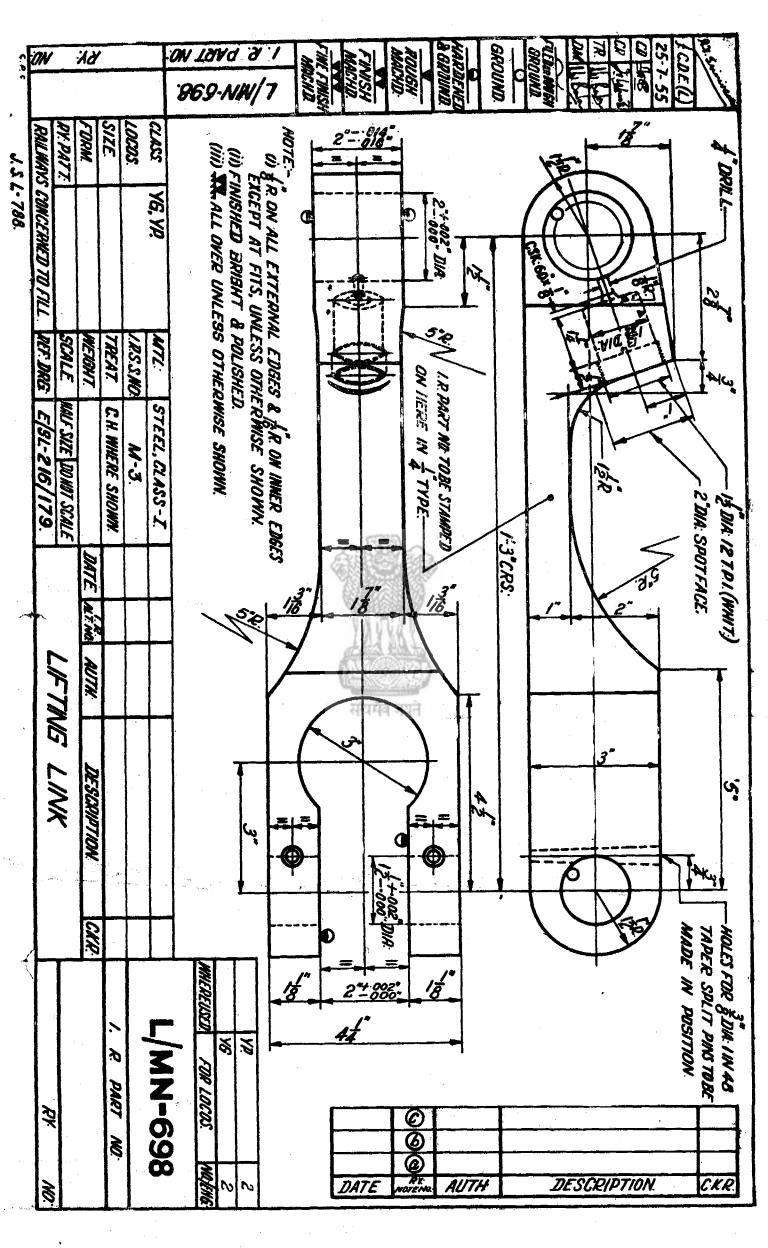


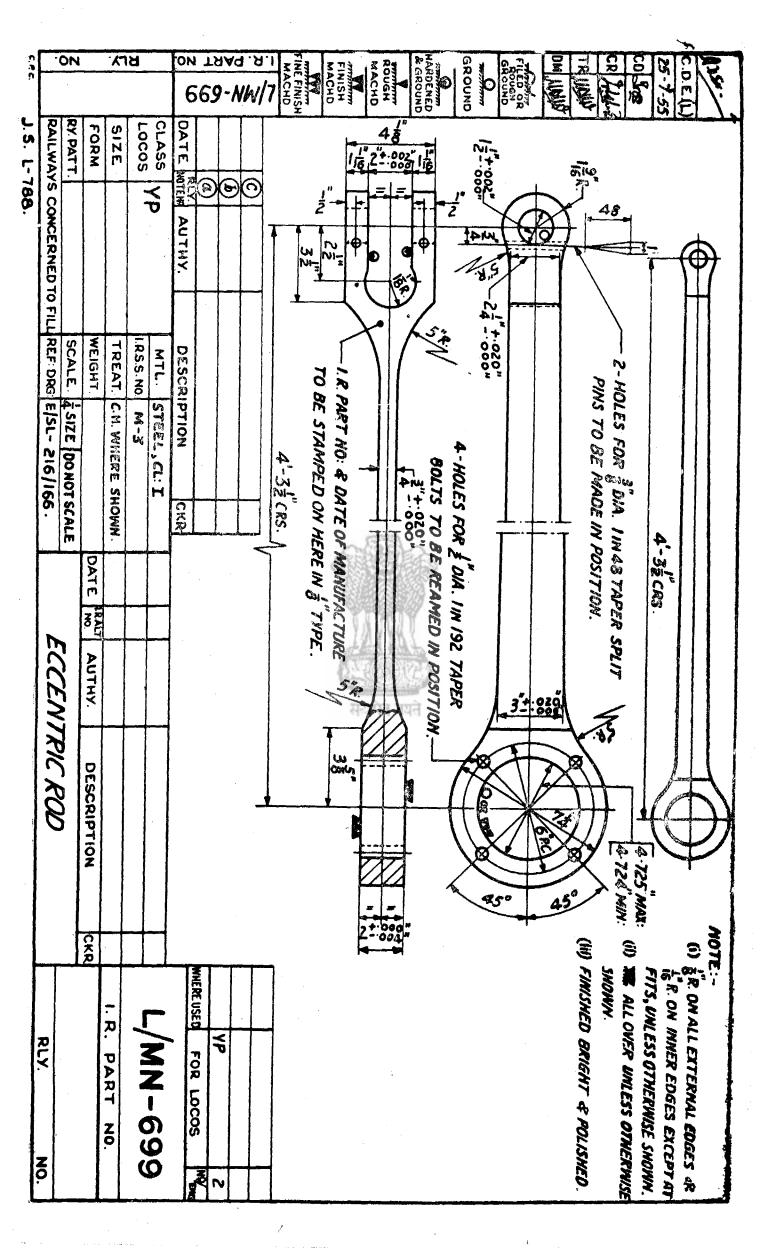


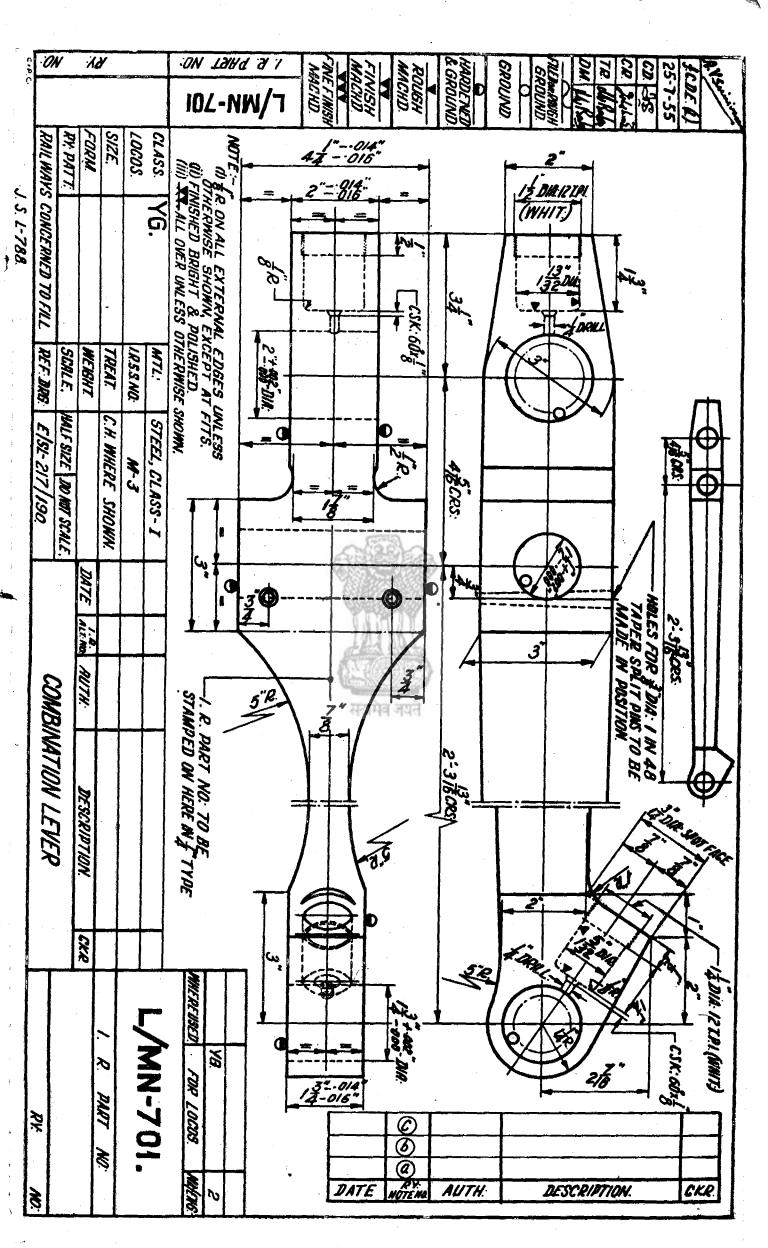


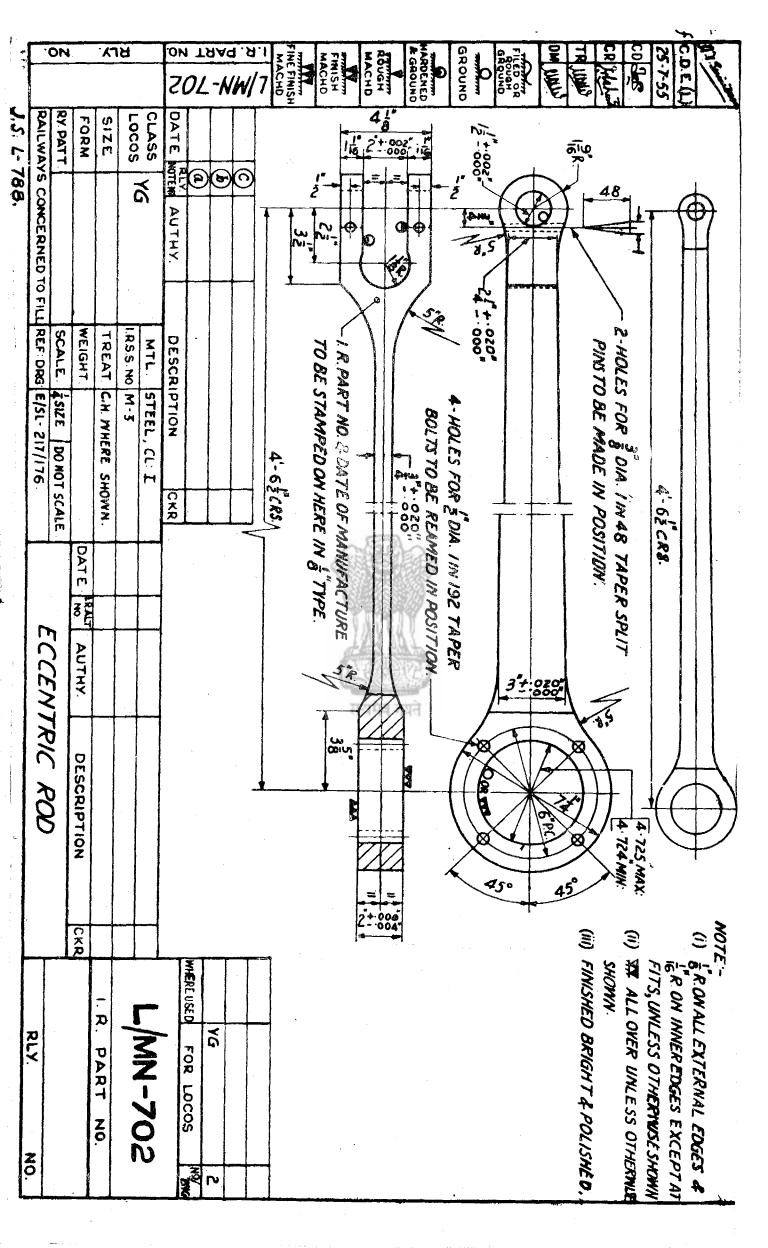


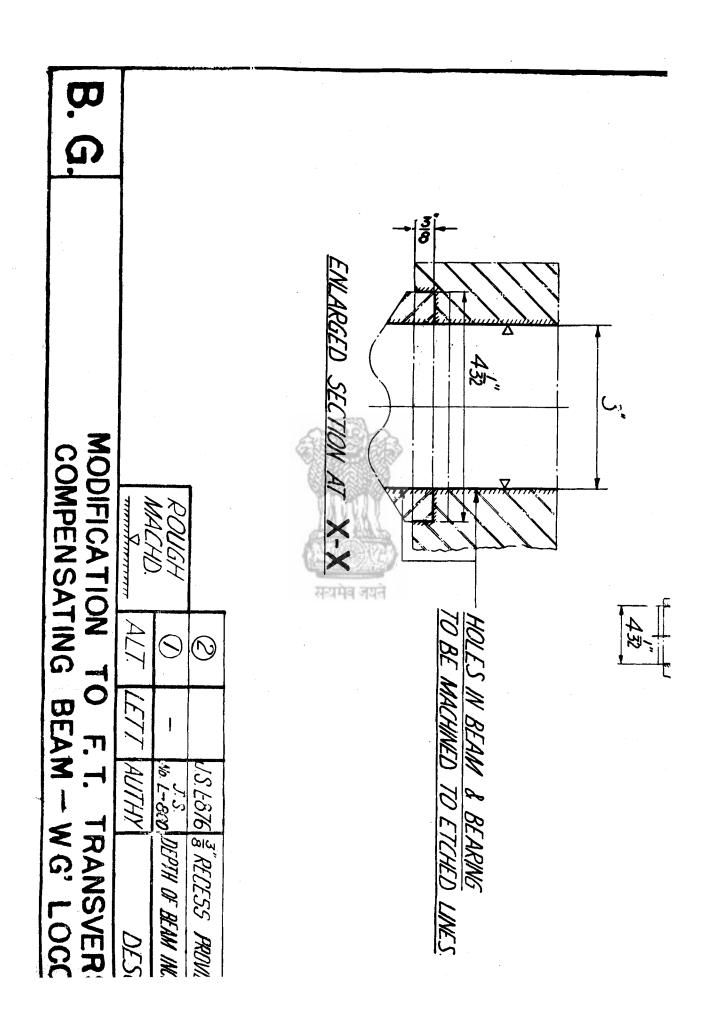












WG' LOCOS. **TRANSVERSE** 

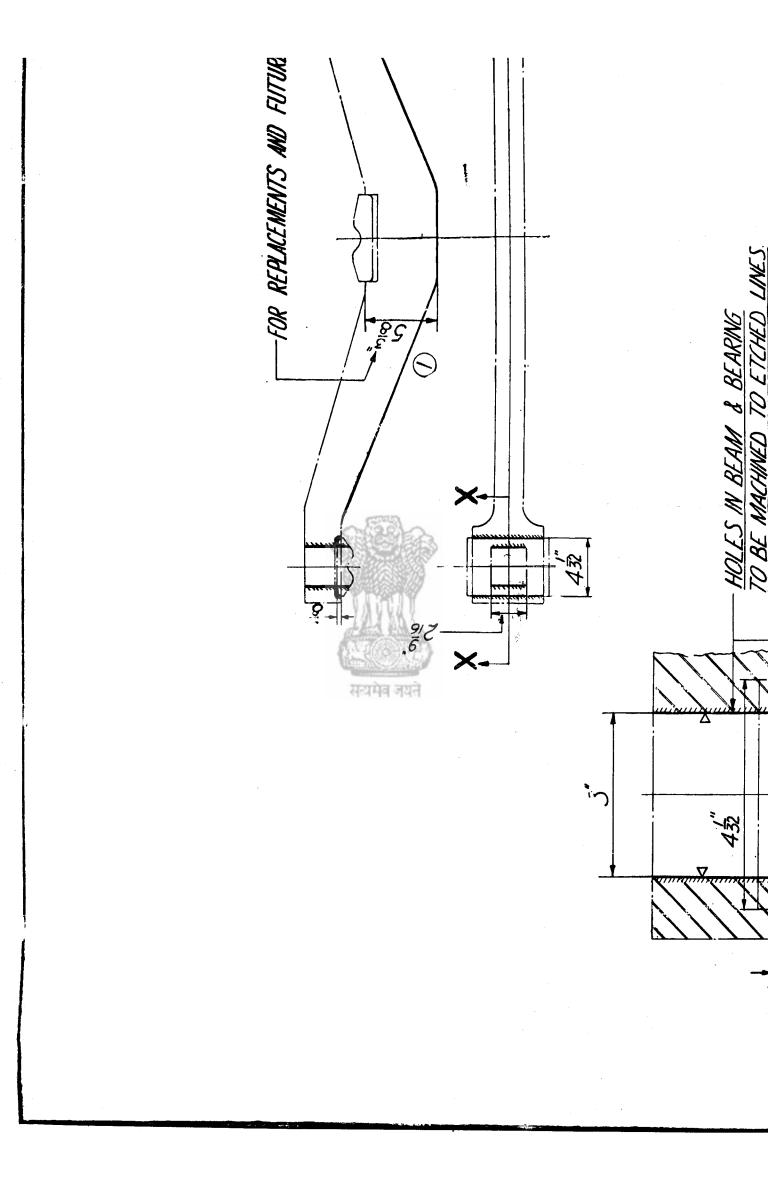
DESCRIPTION

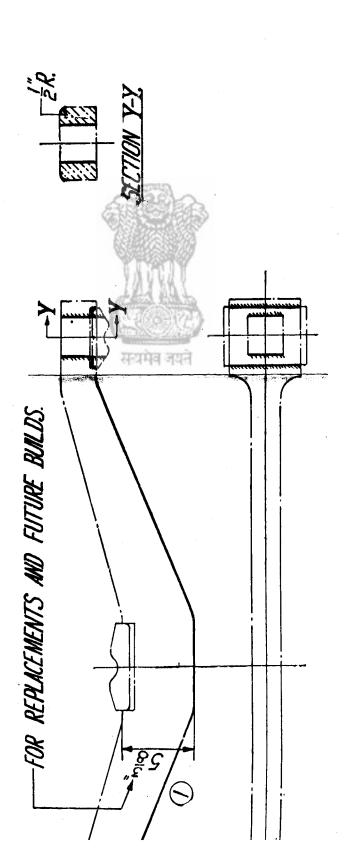
 $5\frac{3}{8}$  Recess provided for bearing masher

7/57

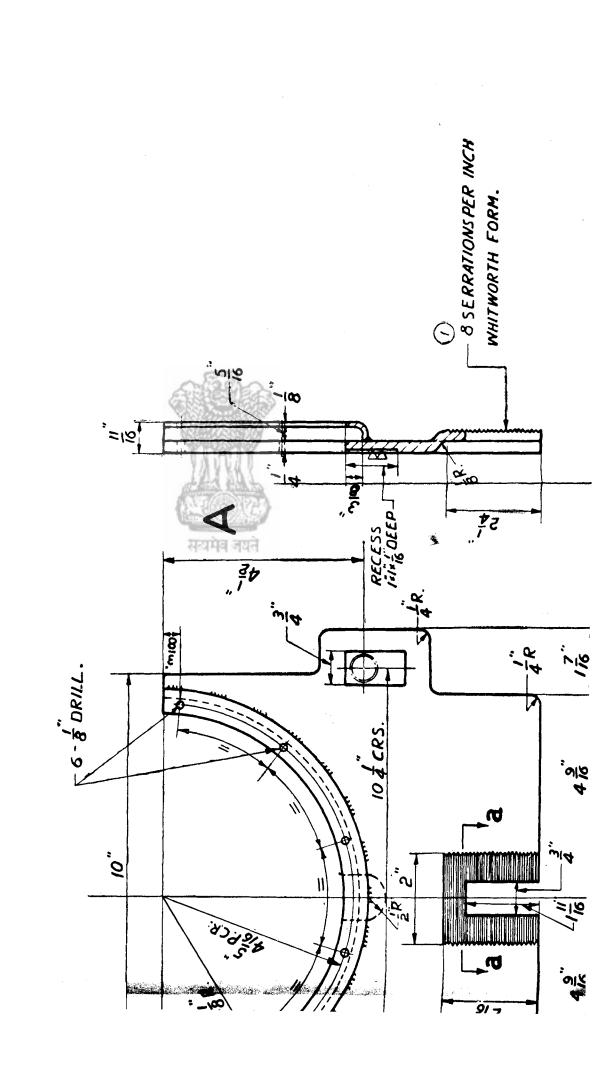
DEPTH OF BEAM INCREASED FROM 5" TO 58. 7/5.5 REFERENCE - B.N. RLYS. DRG. No. 10697 & NBL DRG. No. 49-1067 & CE'S DRG. No. E/SL 127/258.

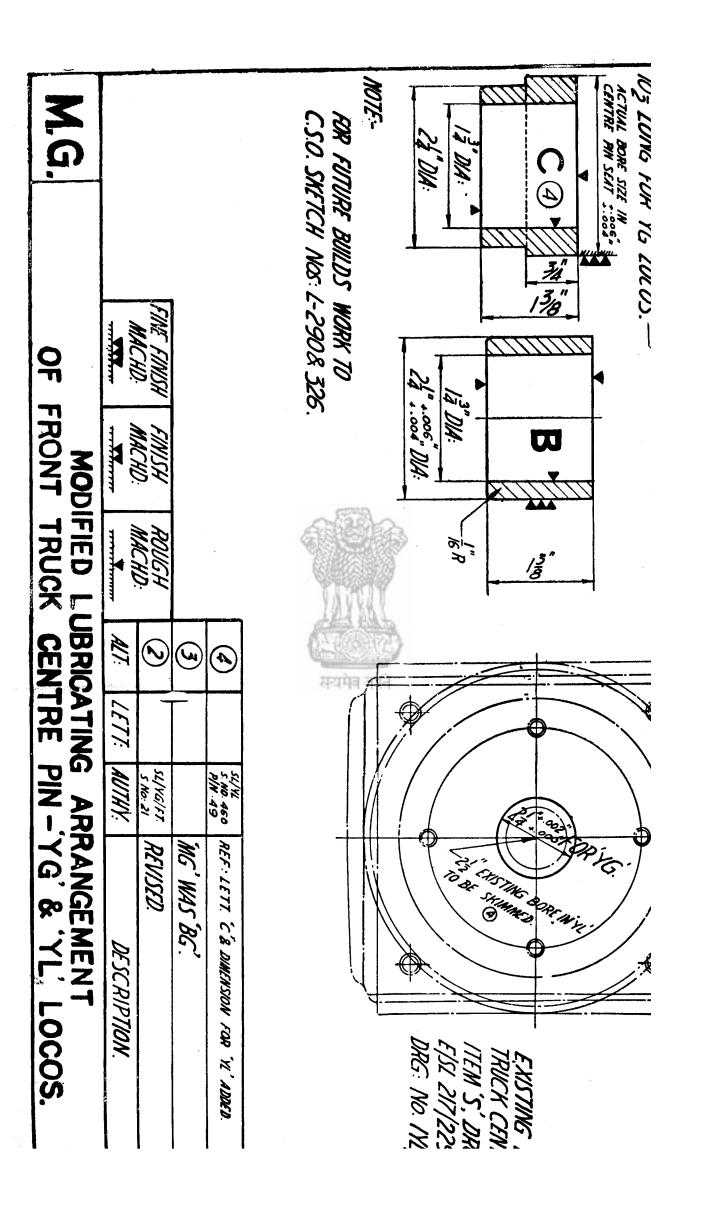
DRG. No. 2020

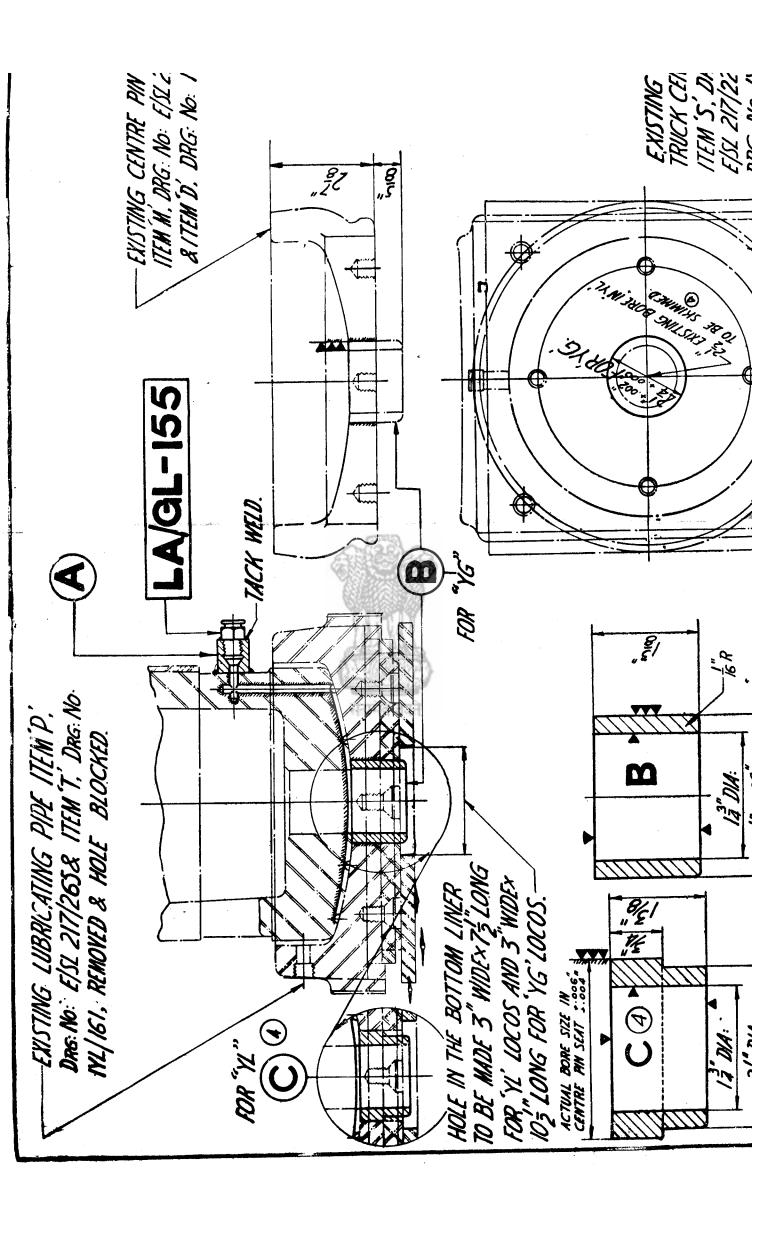


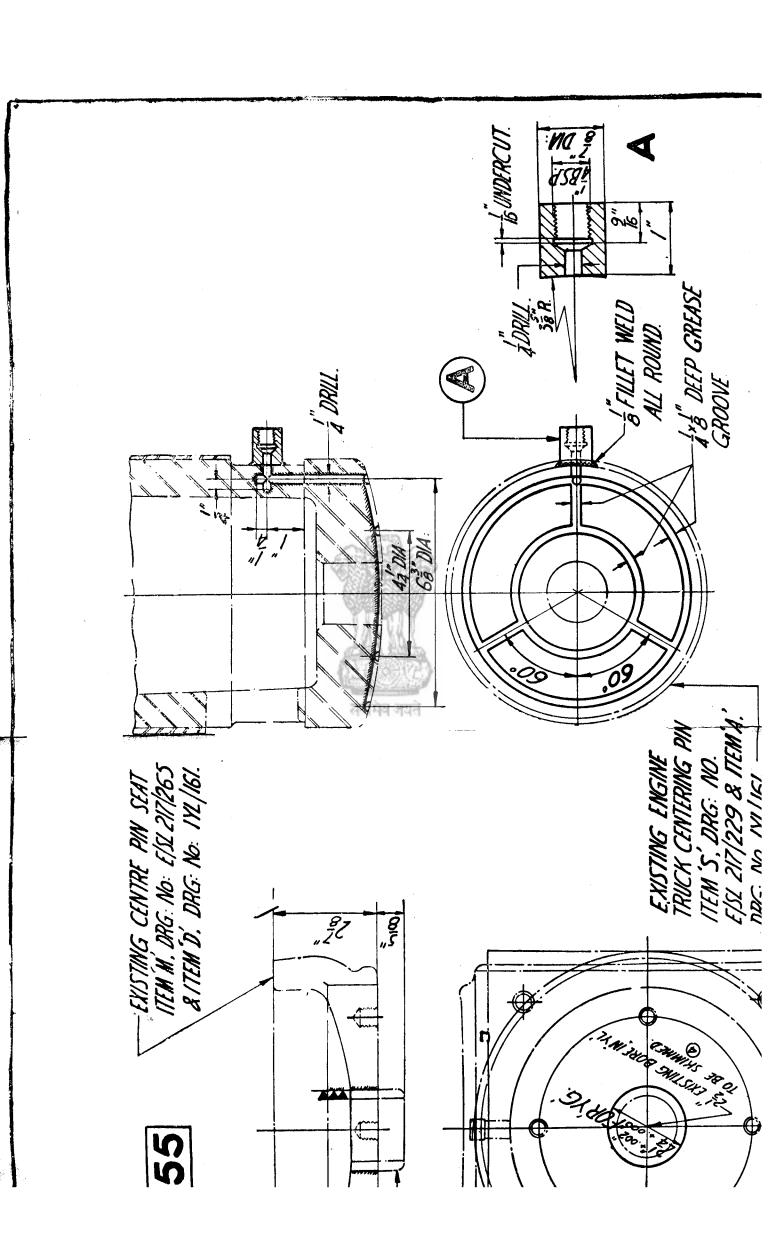


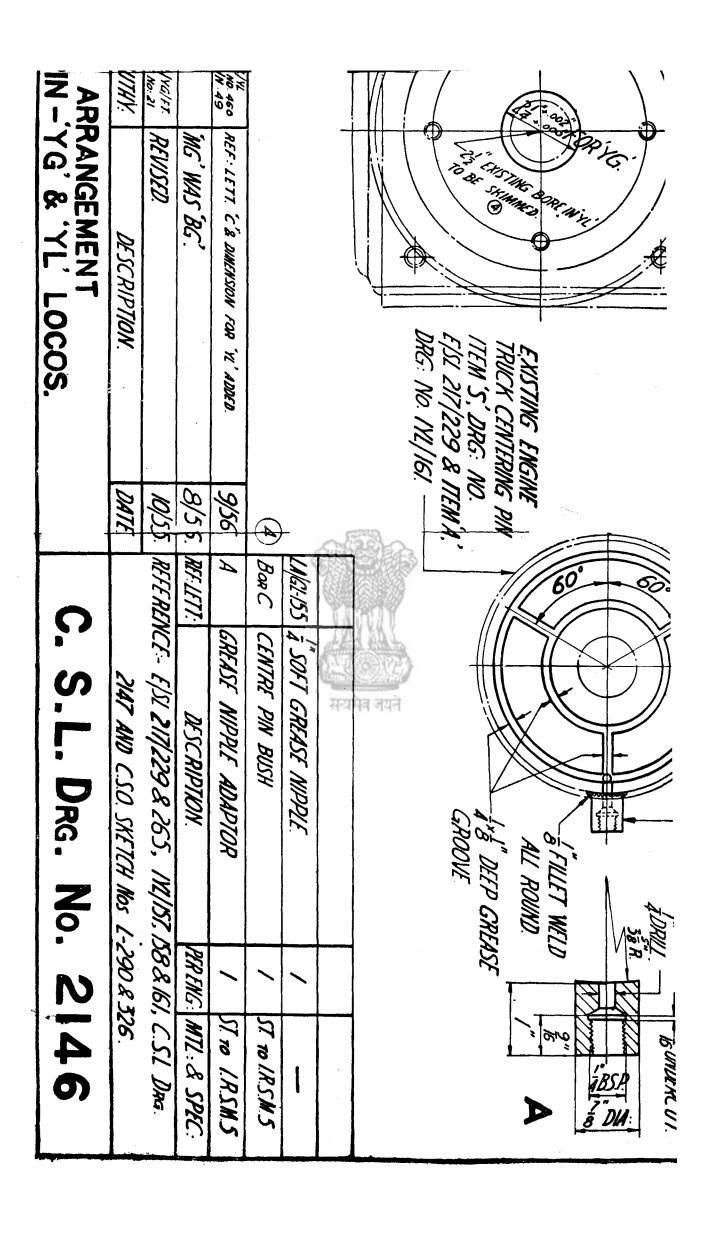
& BEARING TO ETCHED LINES



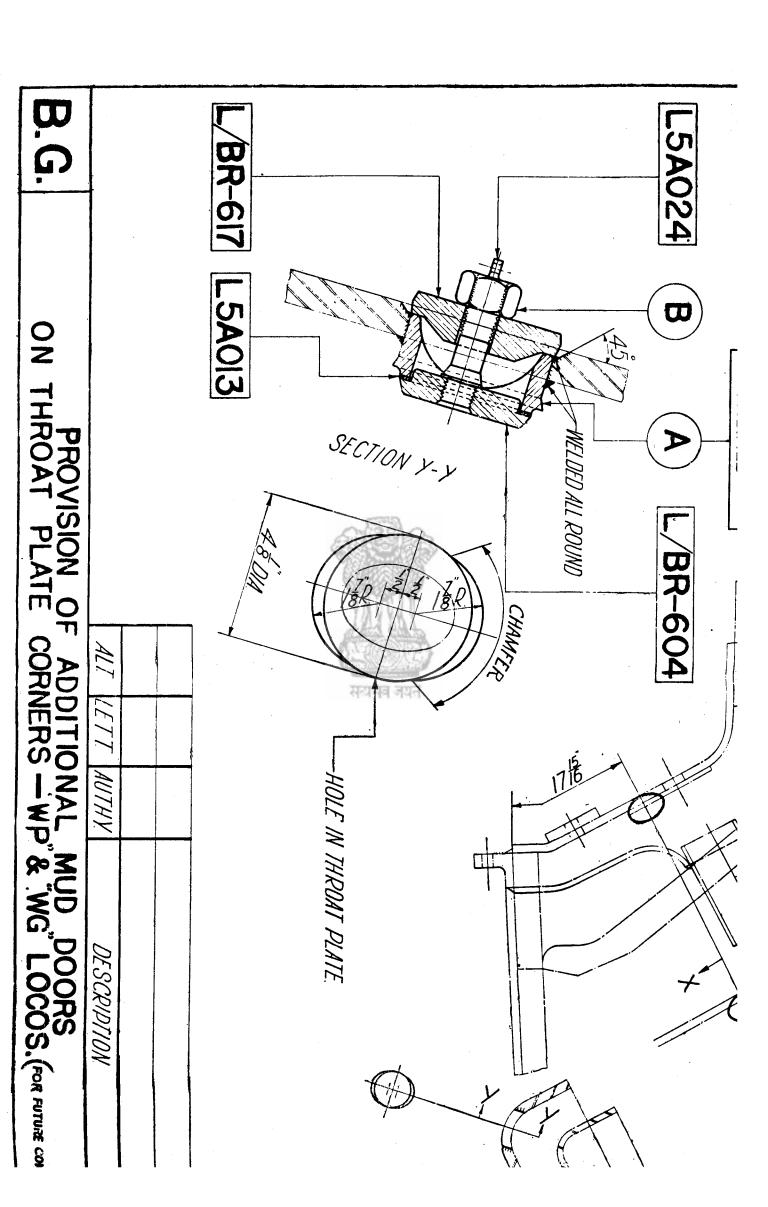


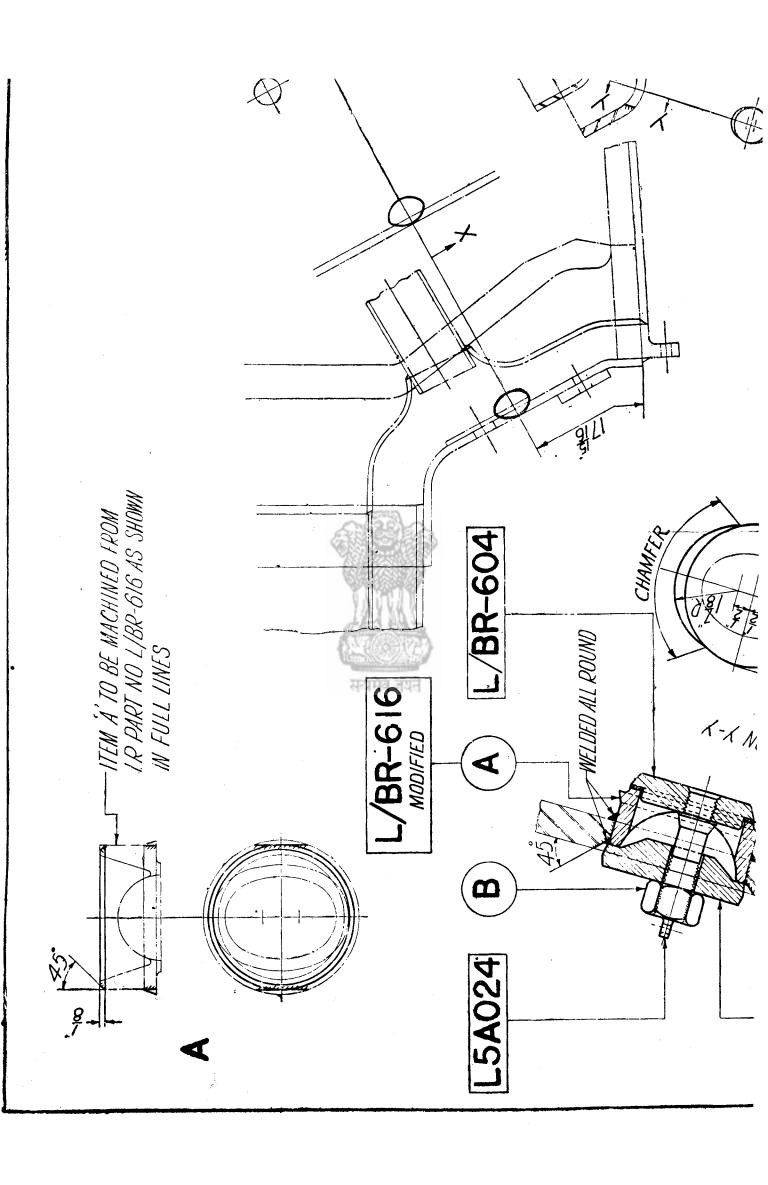


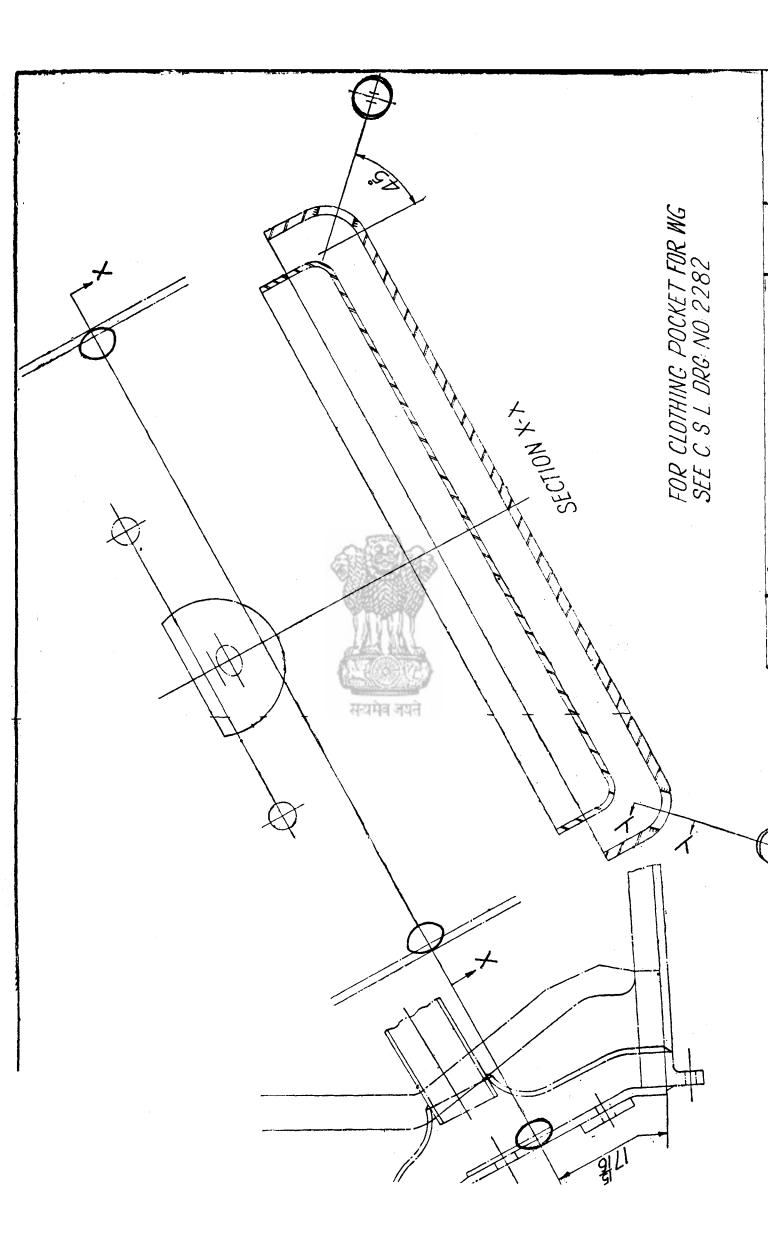


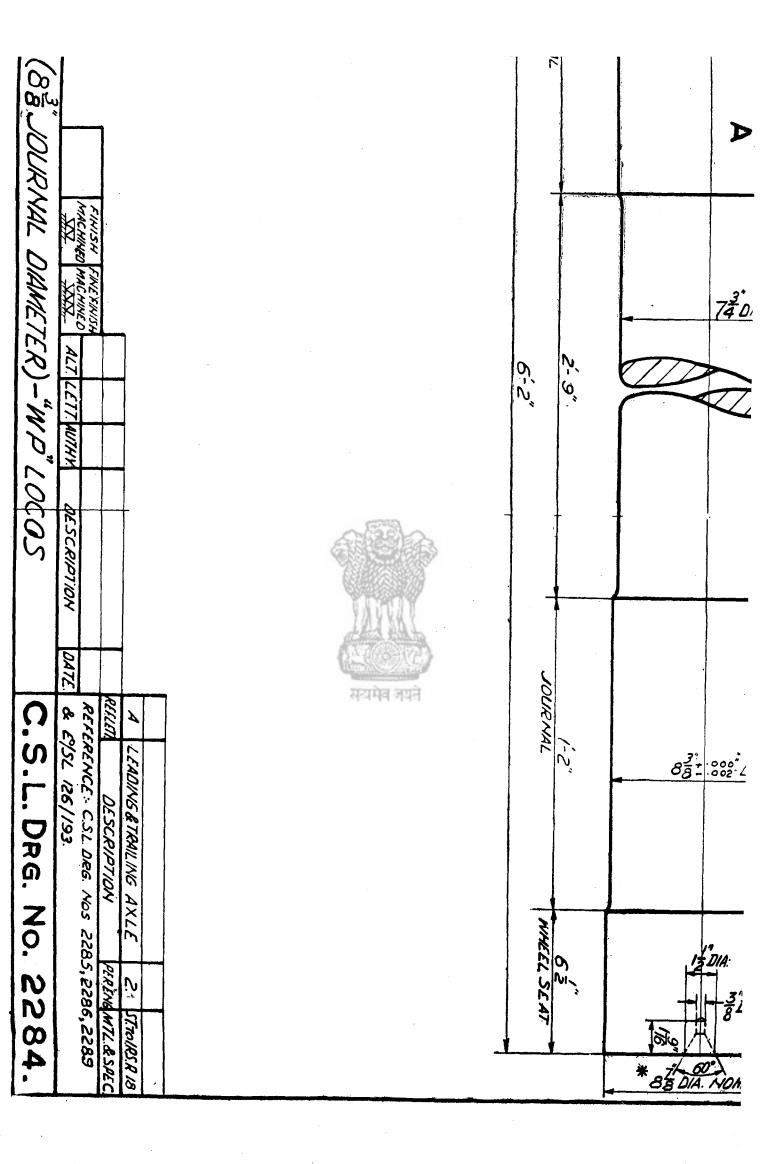


-WP & WG LOCOS. (FOR FUTURE CONSTRUCTION)	ITHY DESCRIPTION .					7EF 117 111 11 11 11 11 11 11 11 11 11 11 1	THE IN THEORIE DIATE			
C. S. L. DRG:No. 2281	DATE REFERENCE:- C.E.'S. D.R.G. NO. E/SL 126/19 & E/SL 127/10	LEPART NO DESCRIPTION	L/BROOM MUD HOLE DOOR (FLAT)	L/BRSIT BRIDGE FOR MUD DOOR	LSAOIS JOINT RING FOR MUD DOOR	L5A024 STUD FOR MUD DOOR	A FLAT SEATING FOR MUD DOOR	B ZBSWNUT	FOR CLOTHING POCKET FOR ING SEE C S L DRG NO 2282	SECTION X:X
2281.		PERENC MIL & SPEC	2 SICITIOIRSM3	2 SICIII TO IRSM3	2 LEAD	2 STEEL TO I RS M 5	2 STCLTTOLRSM3	2 STrolps M.5	FOR WG 82	



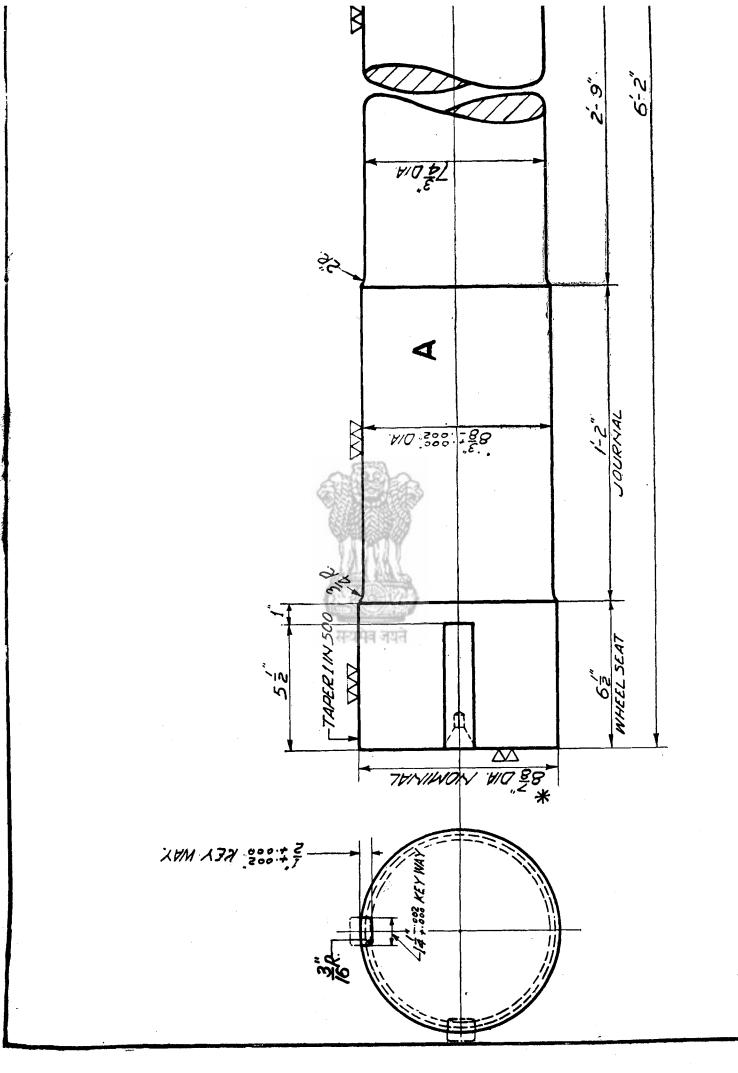


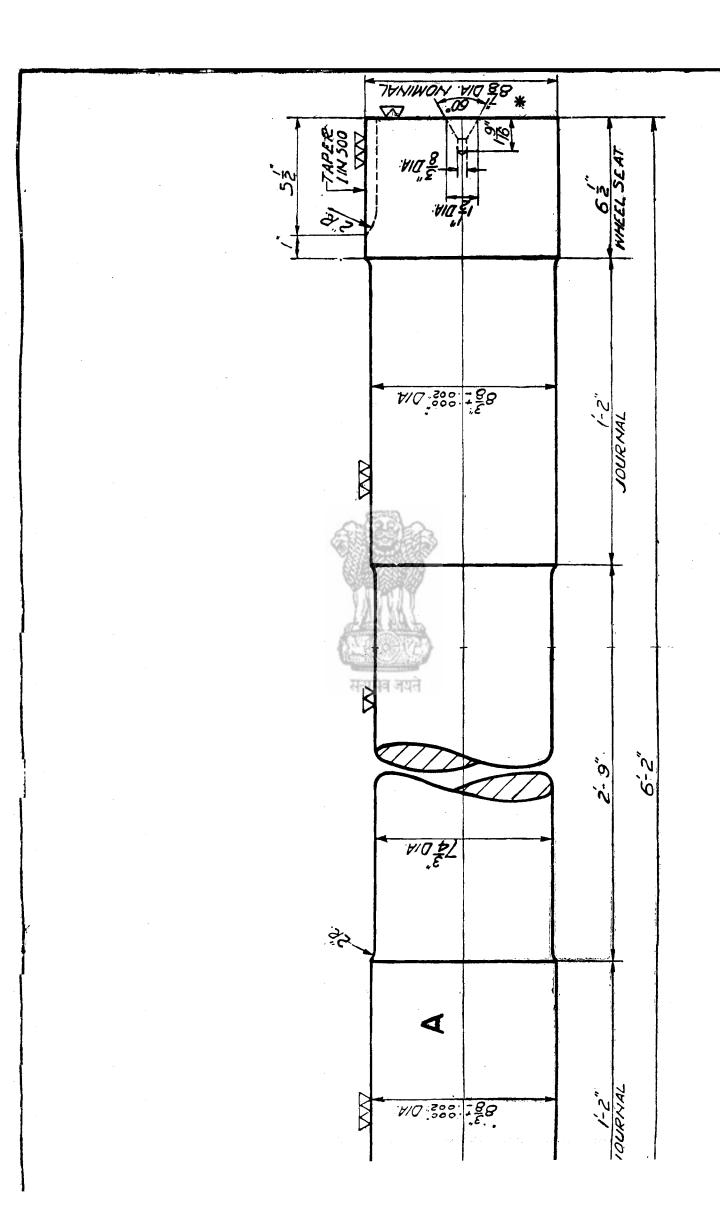


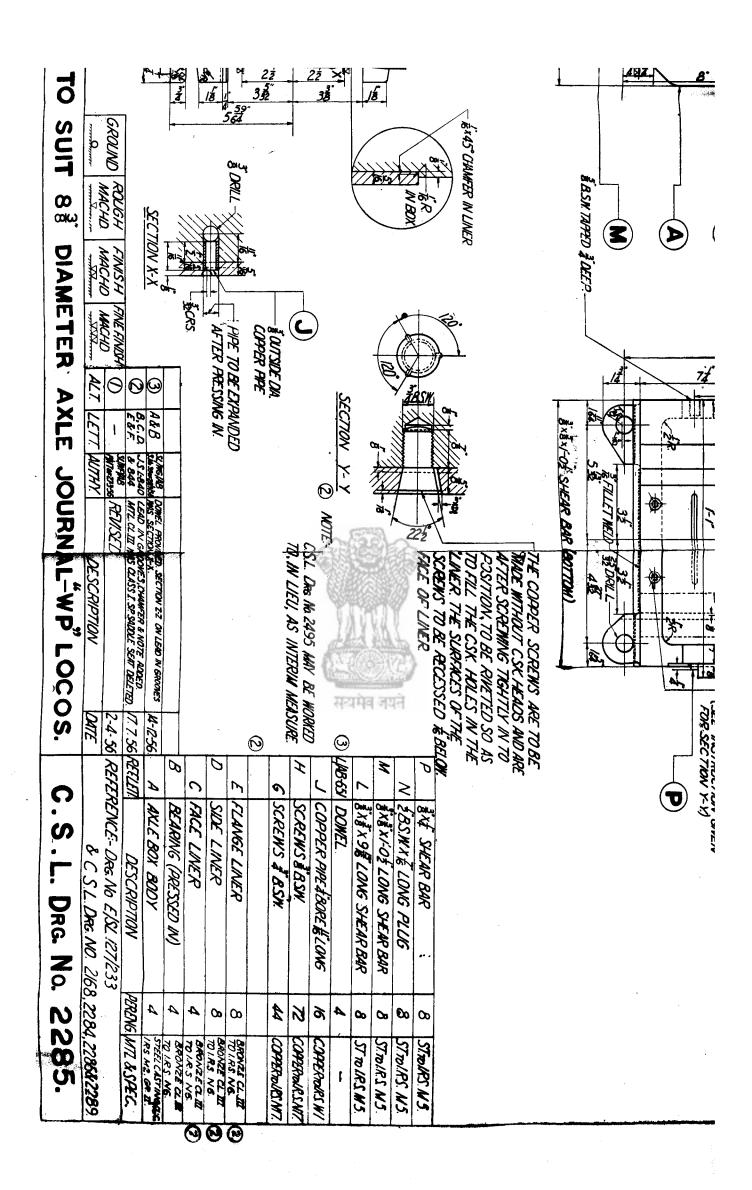


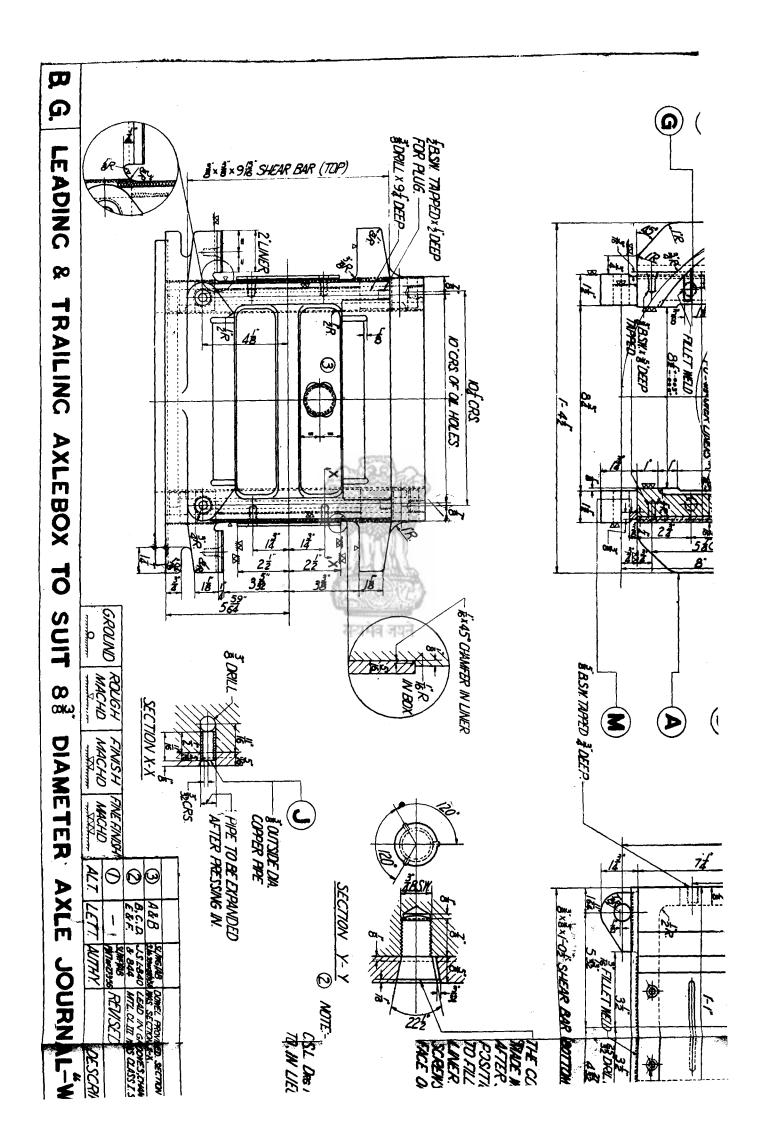
B.G LEADING AND TRAILING COUPLED AXLE (83 JOURNAL DIAMETER)-"MP" LOW NOTE:

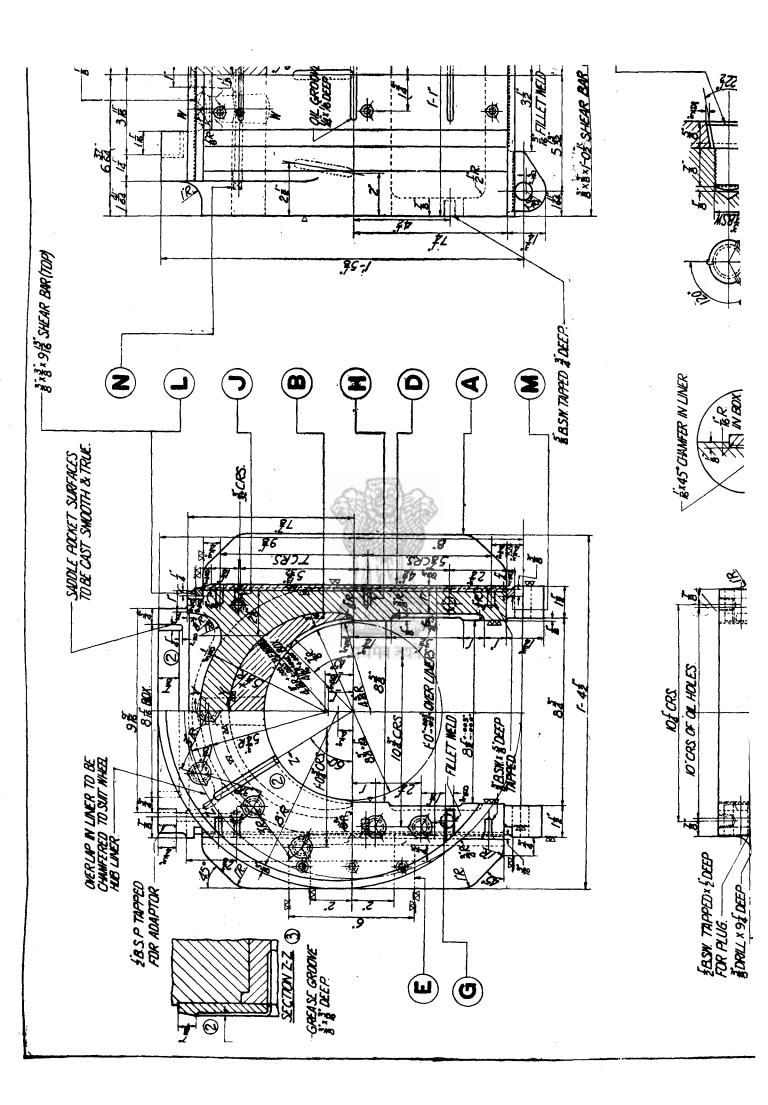
\*THE WHEEL SEATS ARE TO BE TURNED, TO LIA - 888 KEY WAY A TAPER OF 1 IN 500 AND ARE TO BE OF SUCH SPECIFIED IN STANDARD SPECIFICATION NO R.32 DIAMETER AS TO GIVE MOUNTING PRESSURE \* Z". 8≅ DIA. ₩ WHEEL SEAT JOURNAL 88 - .002 DIA. MACHINED MACHINED 74 DIA. ALT LETT AUTHY 2-9" 6-2

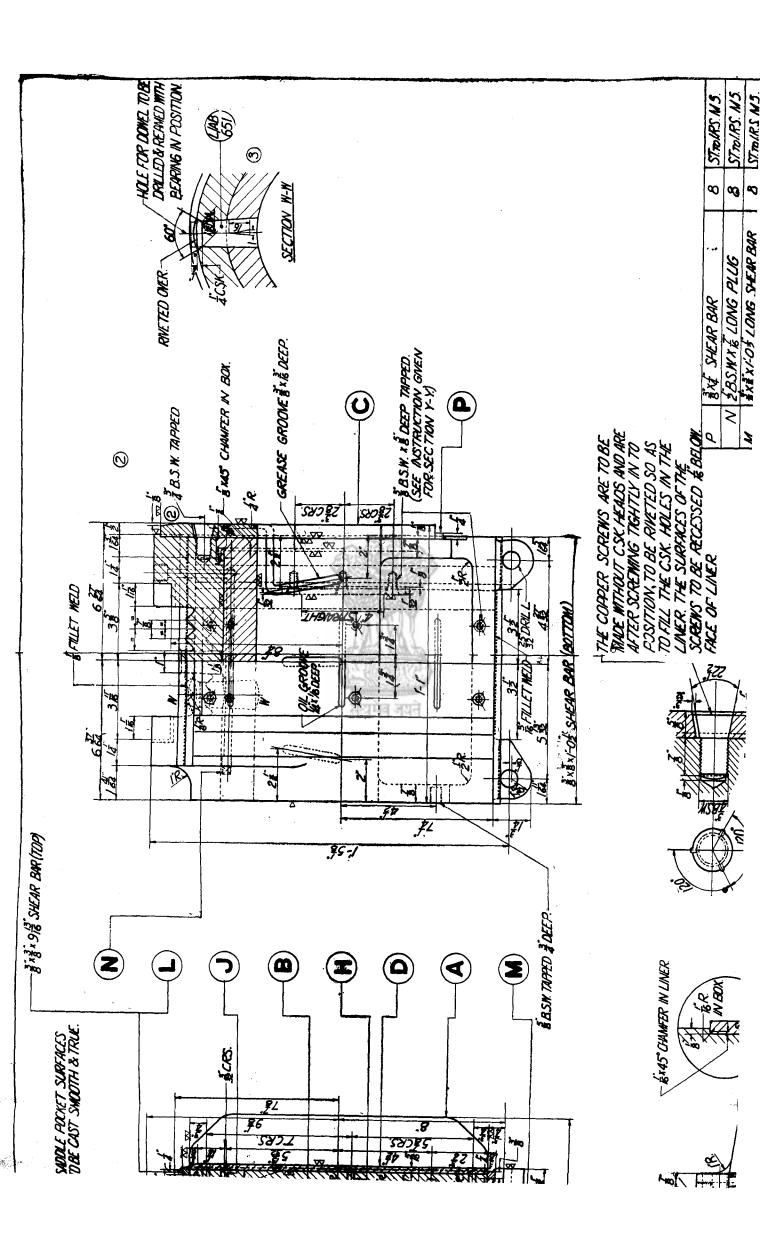


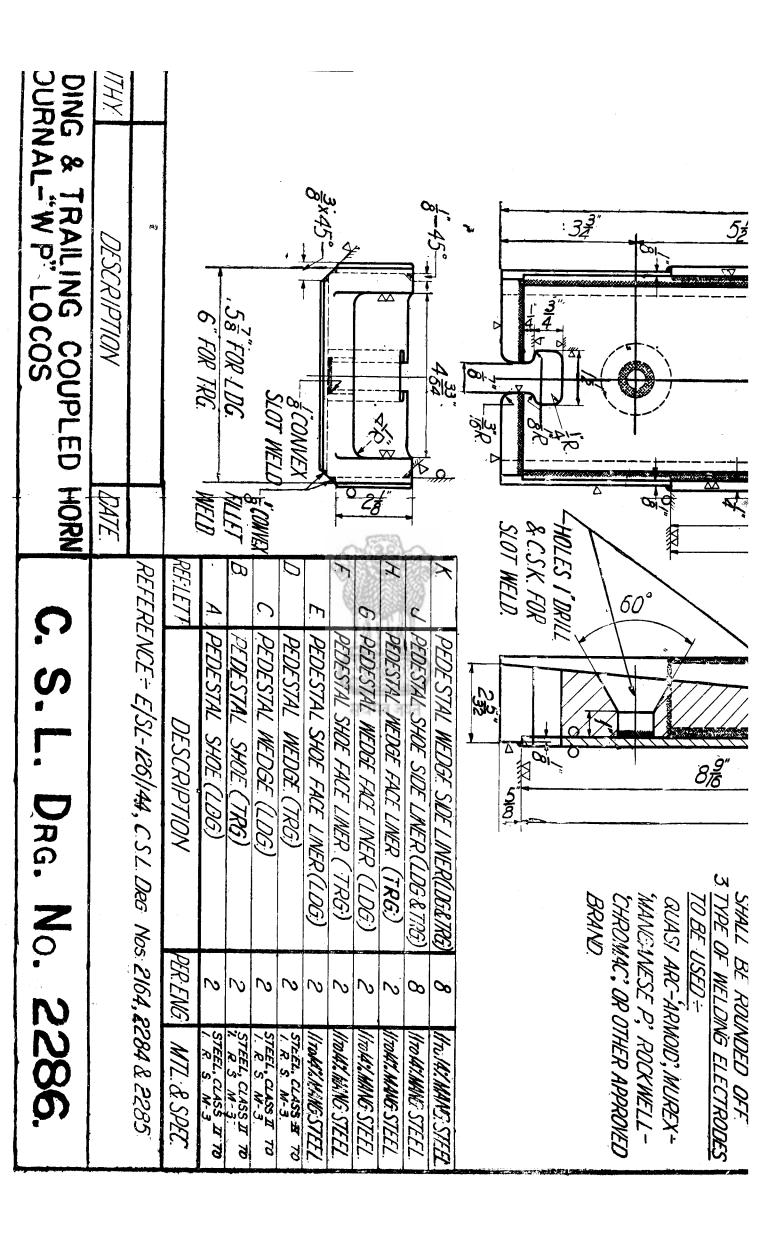


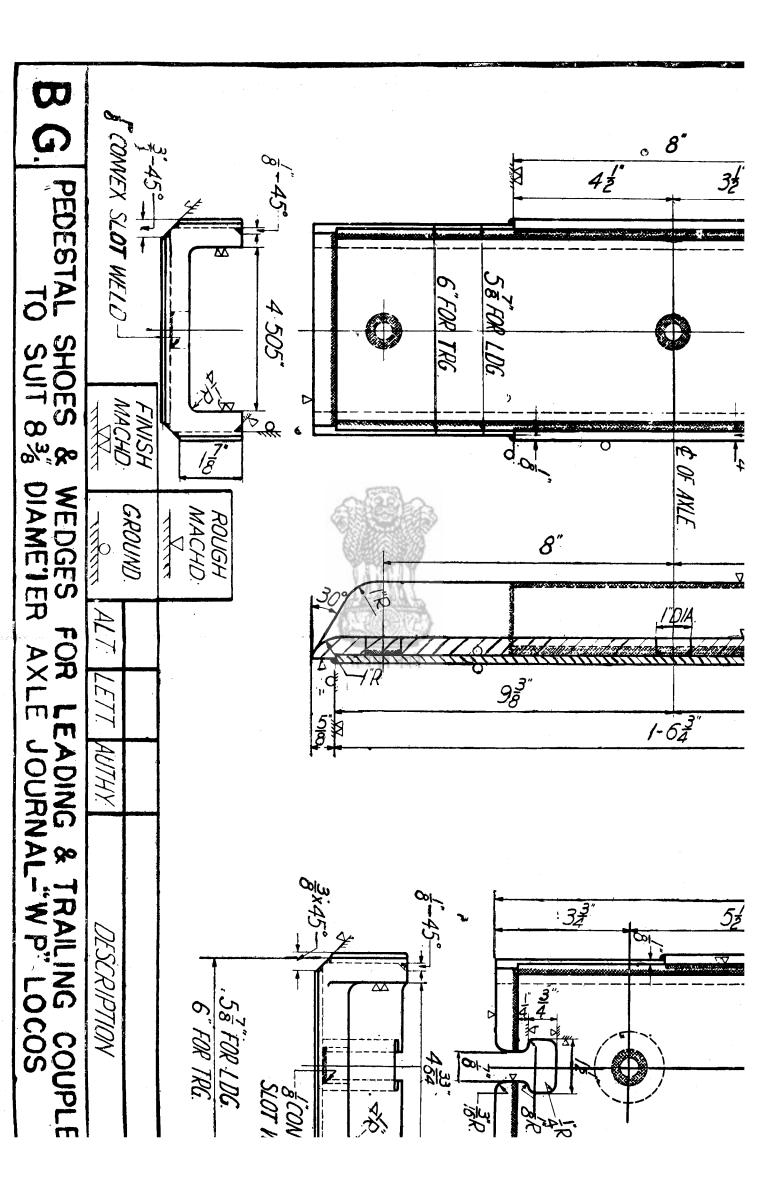


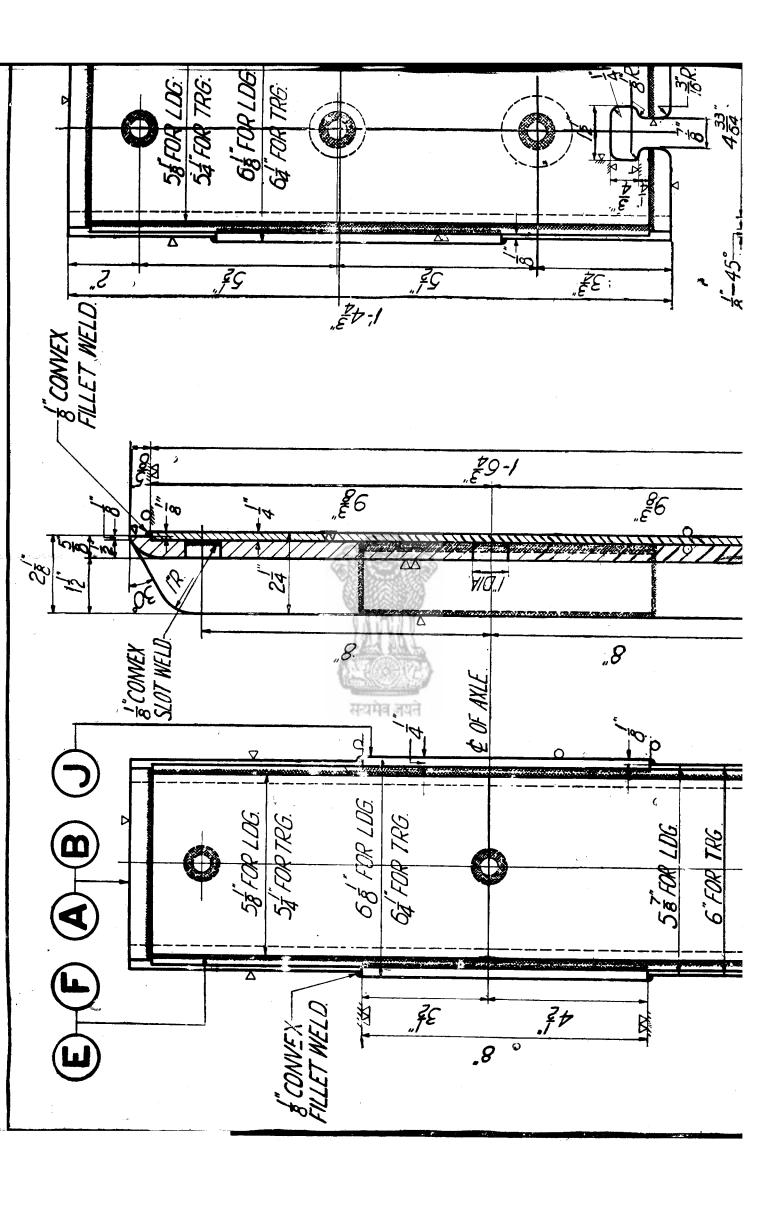


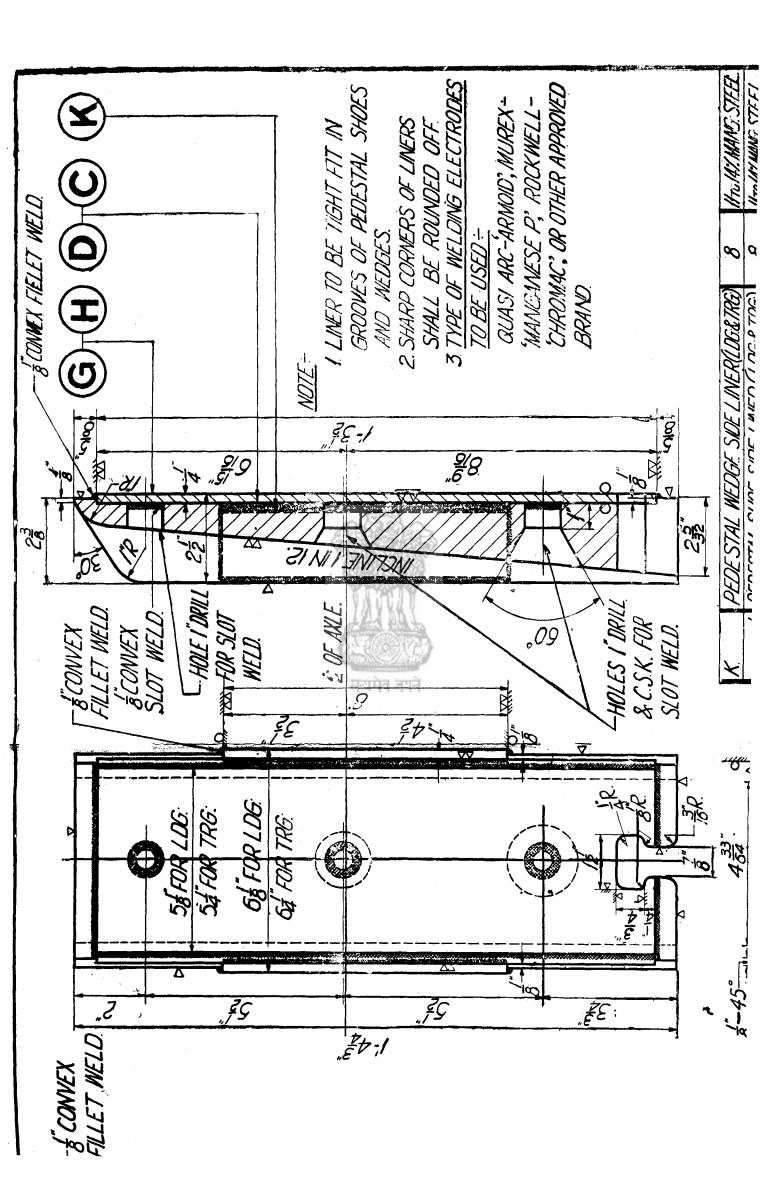


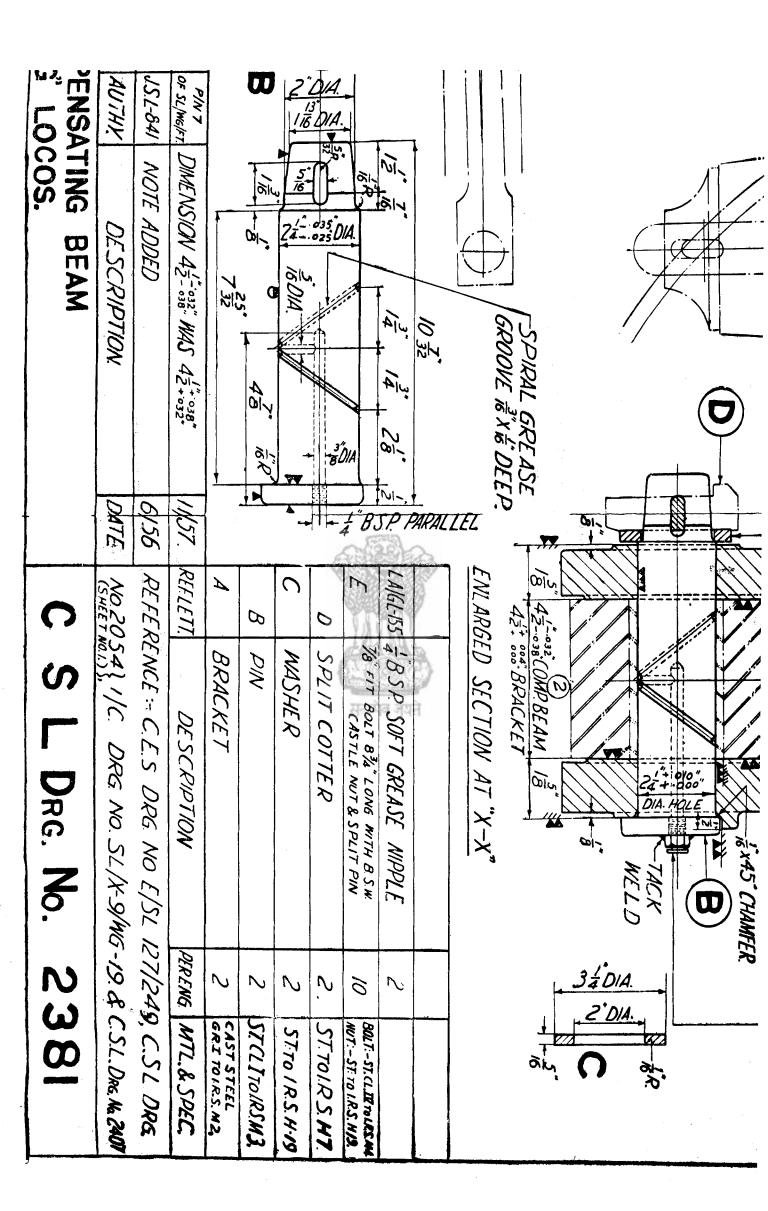


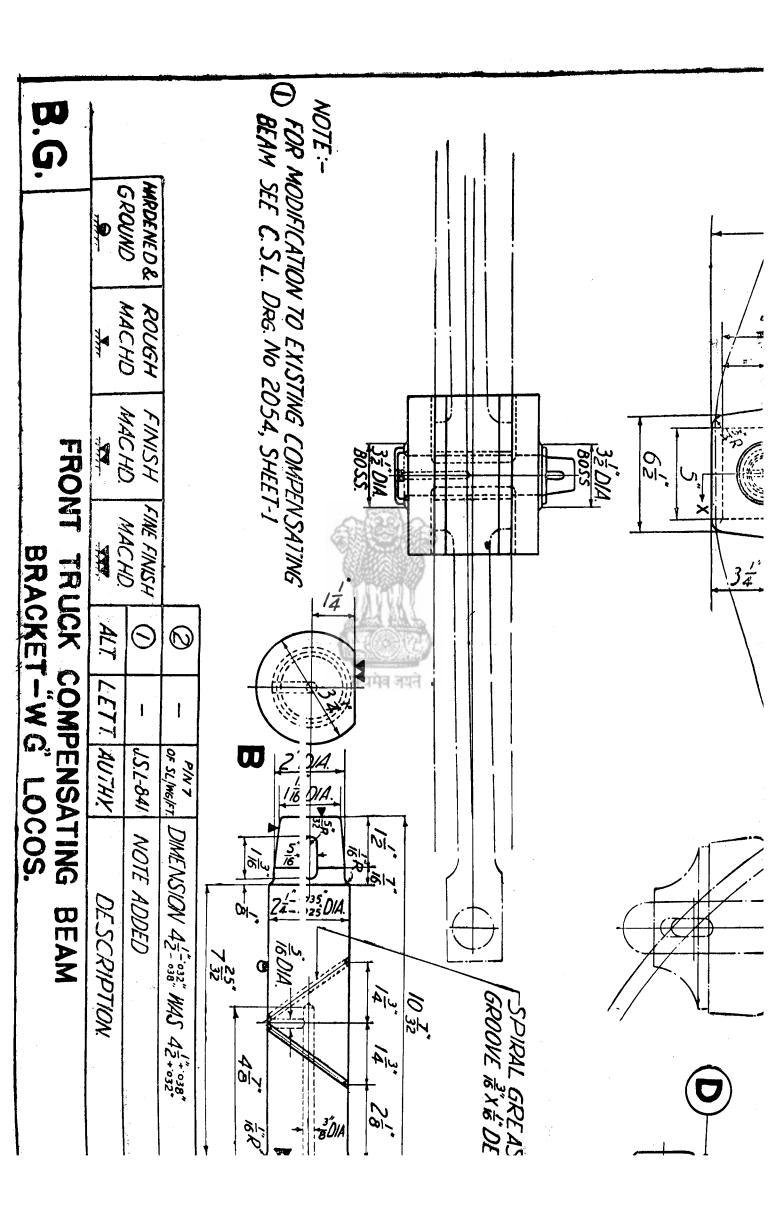


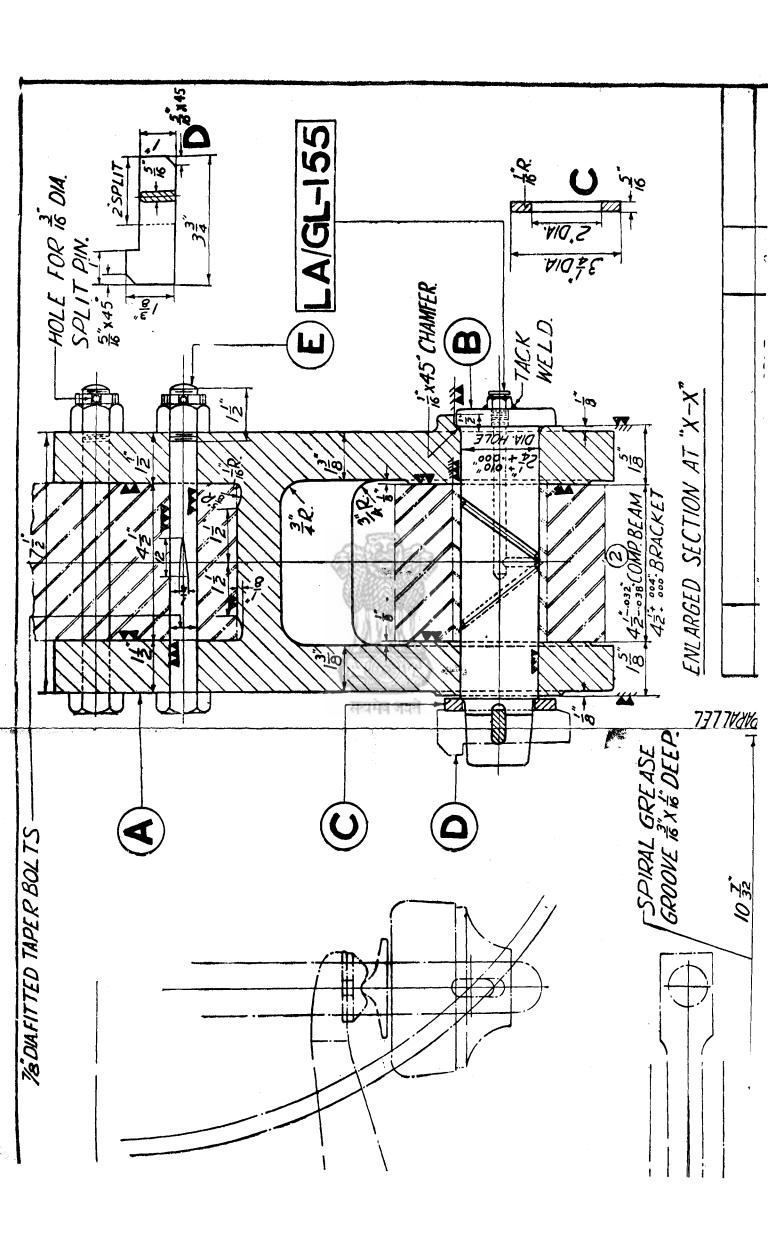


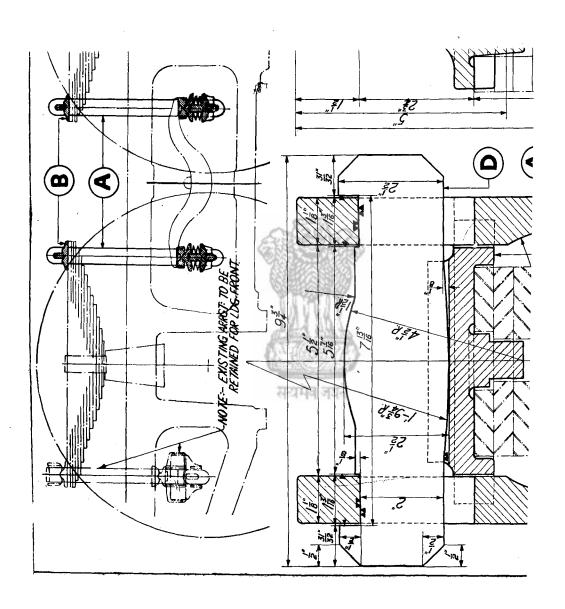


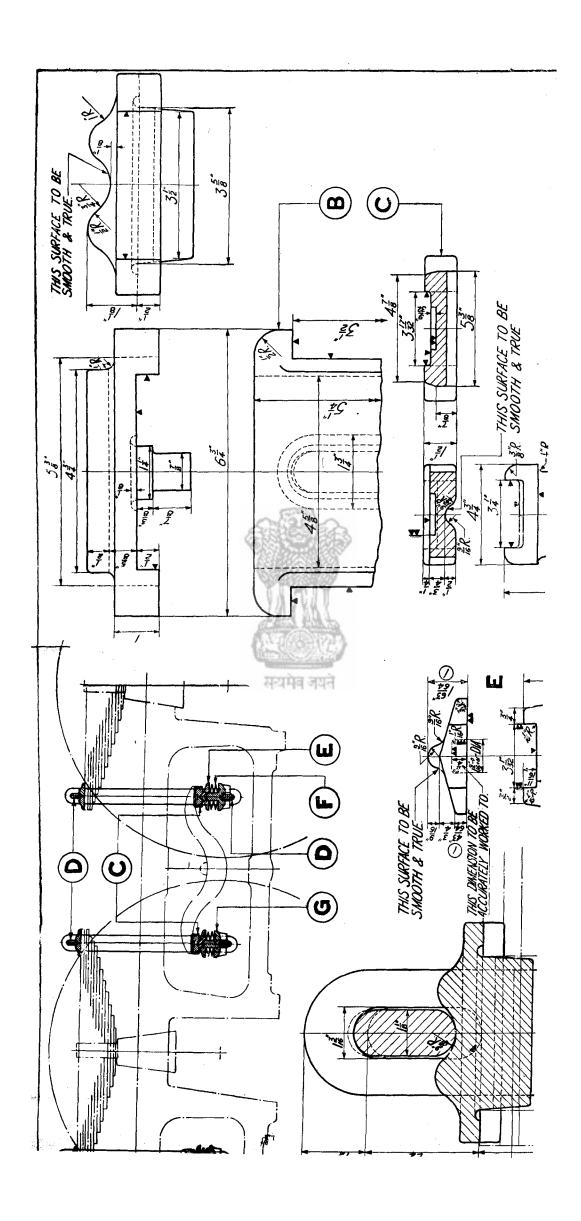


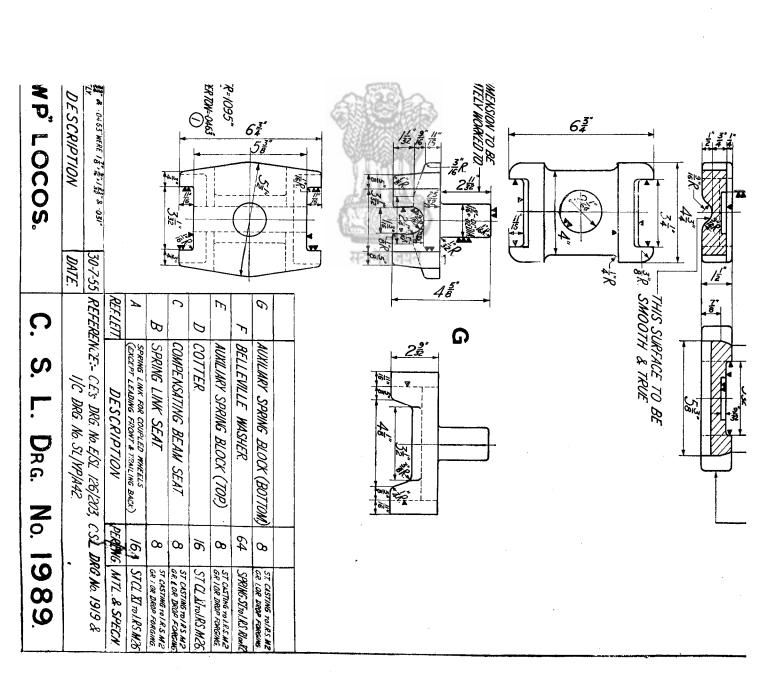


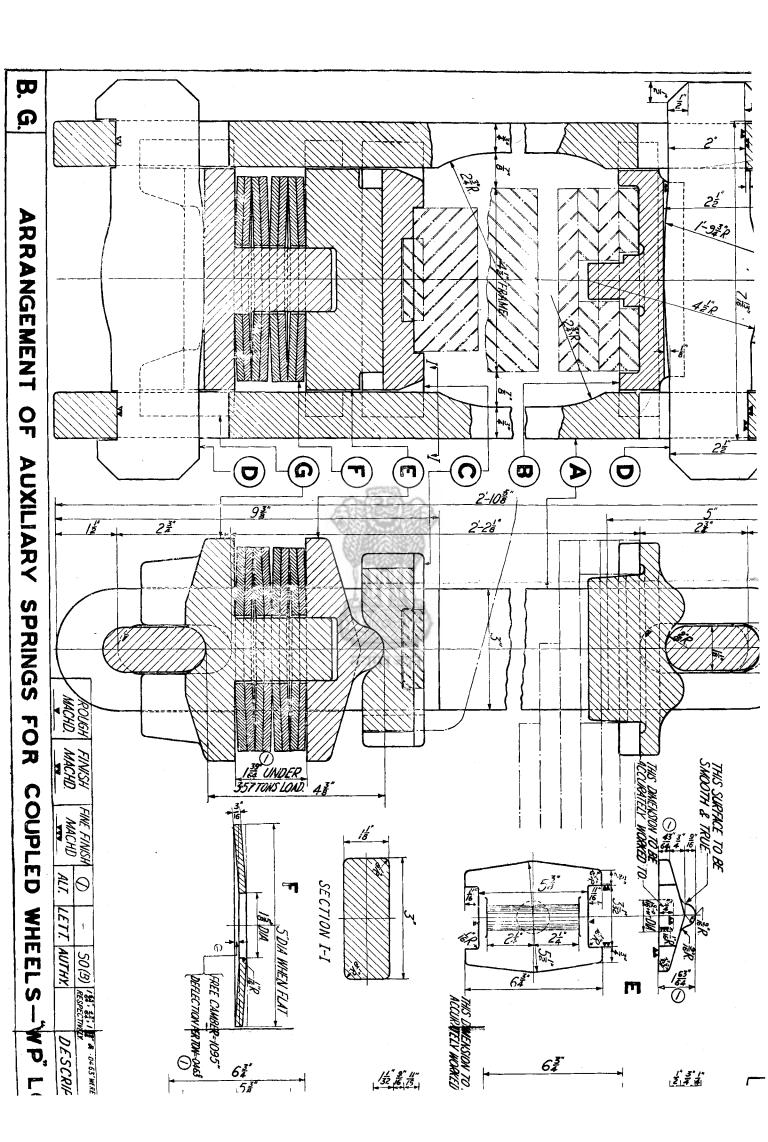


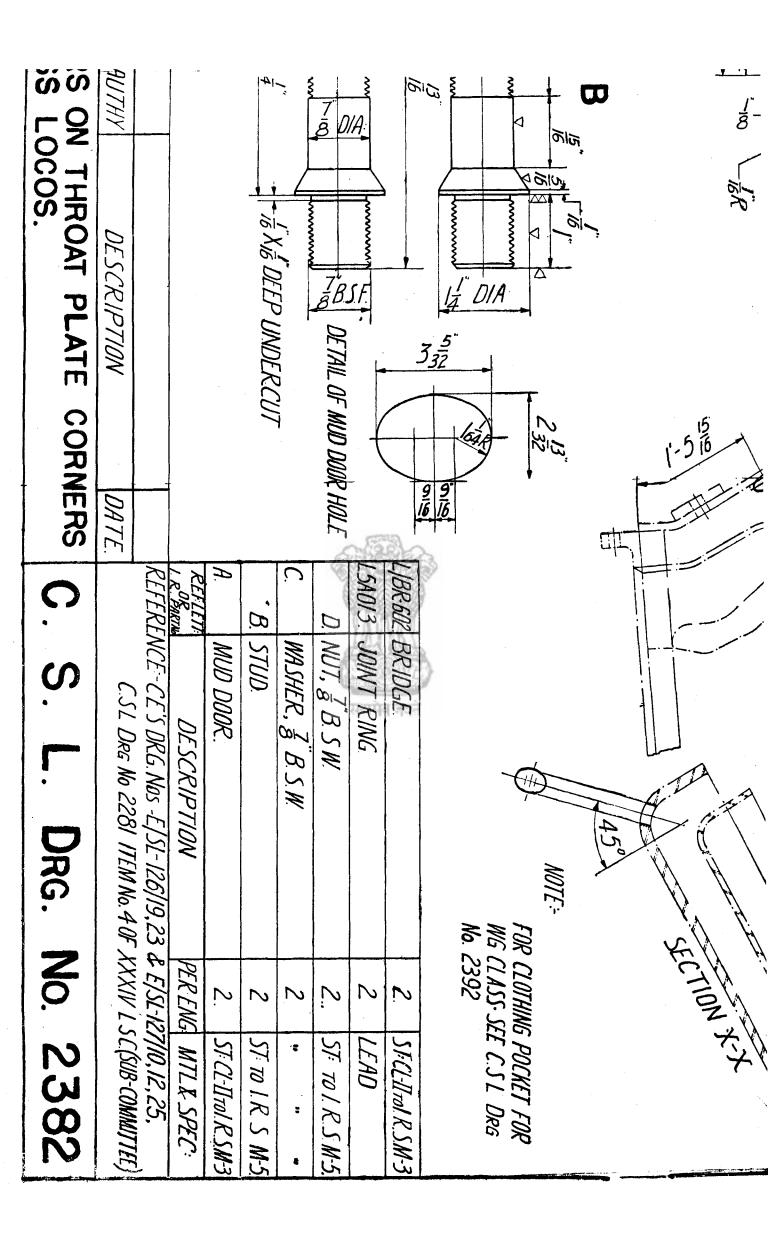


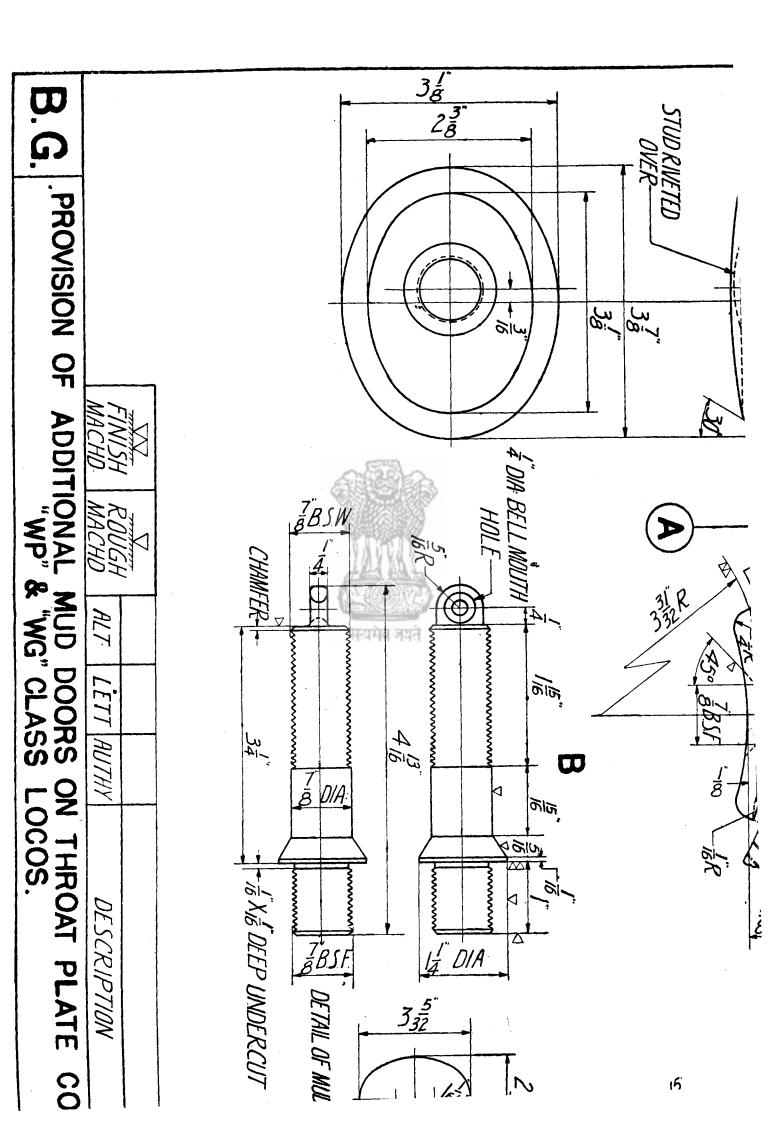


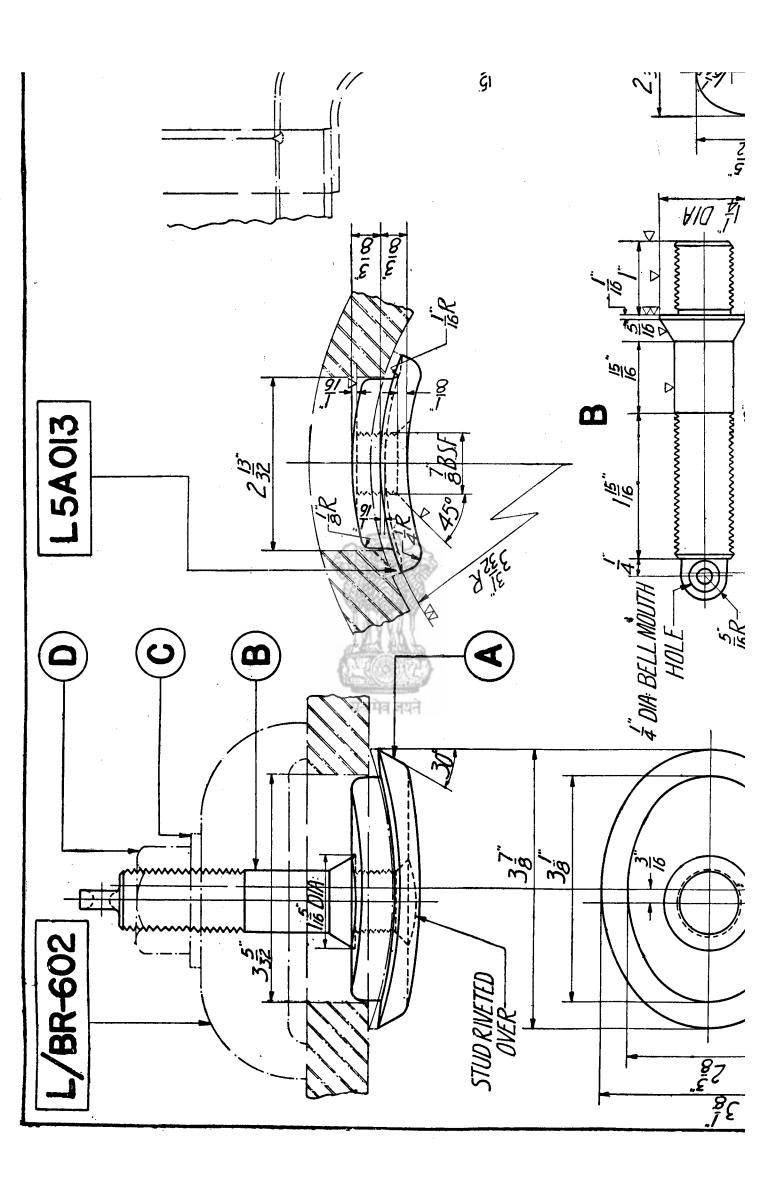


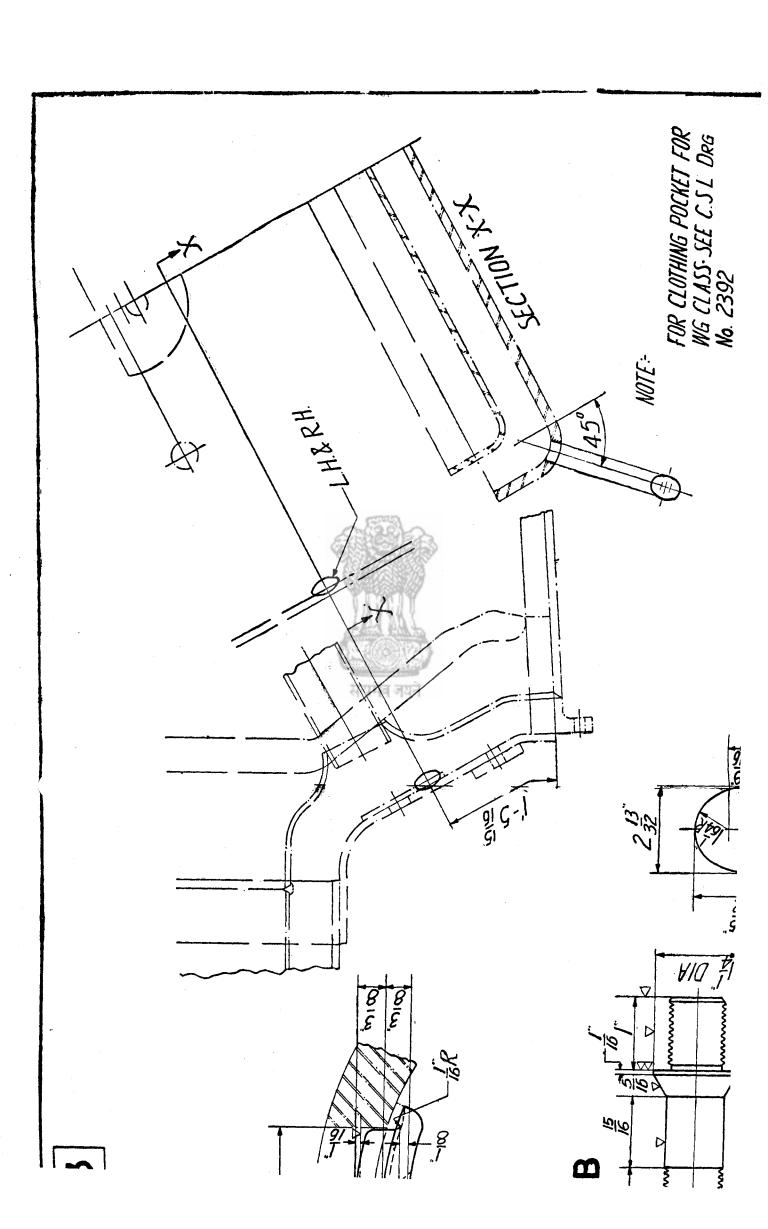


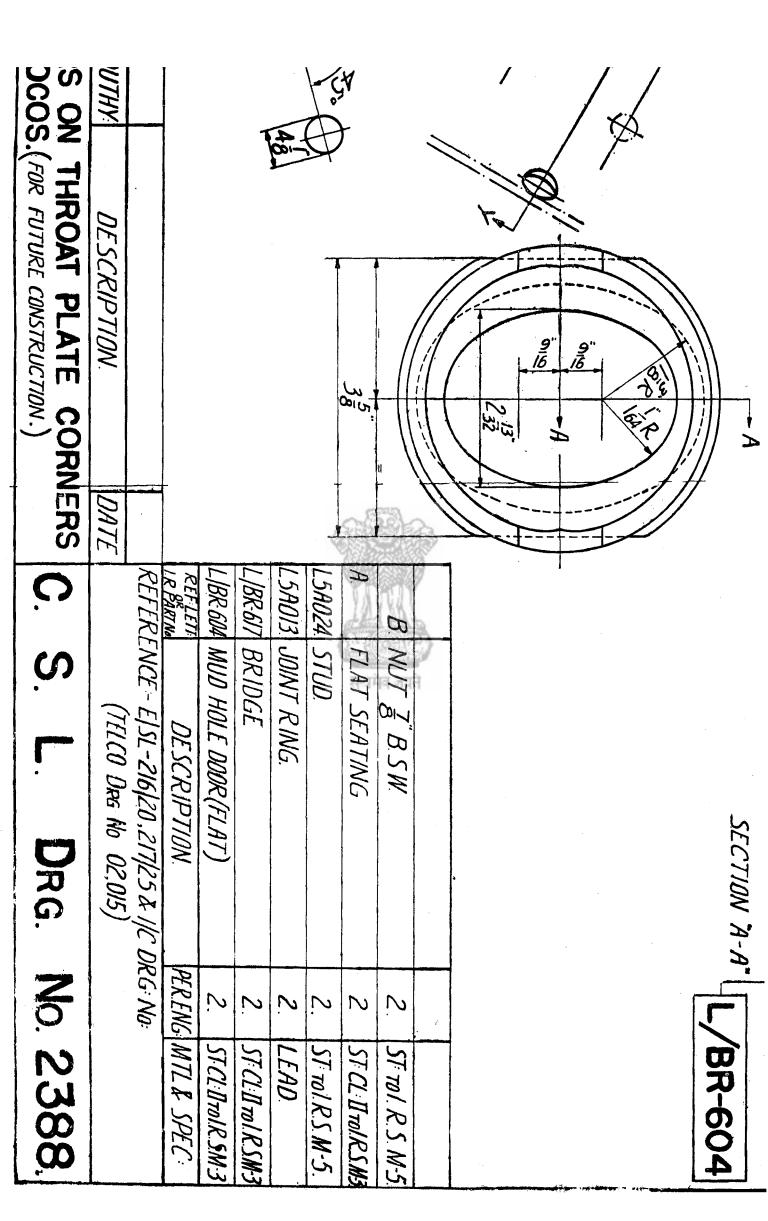


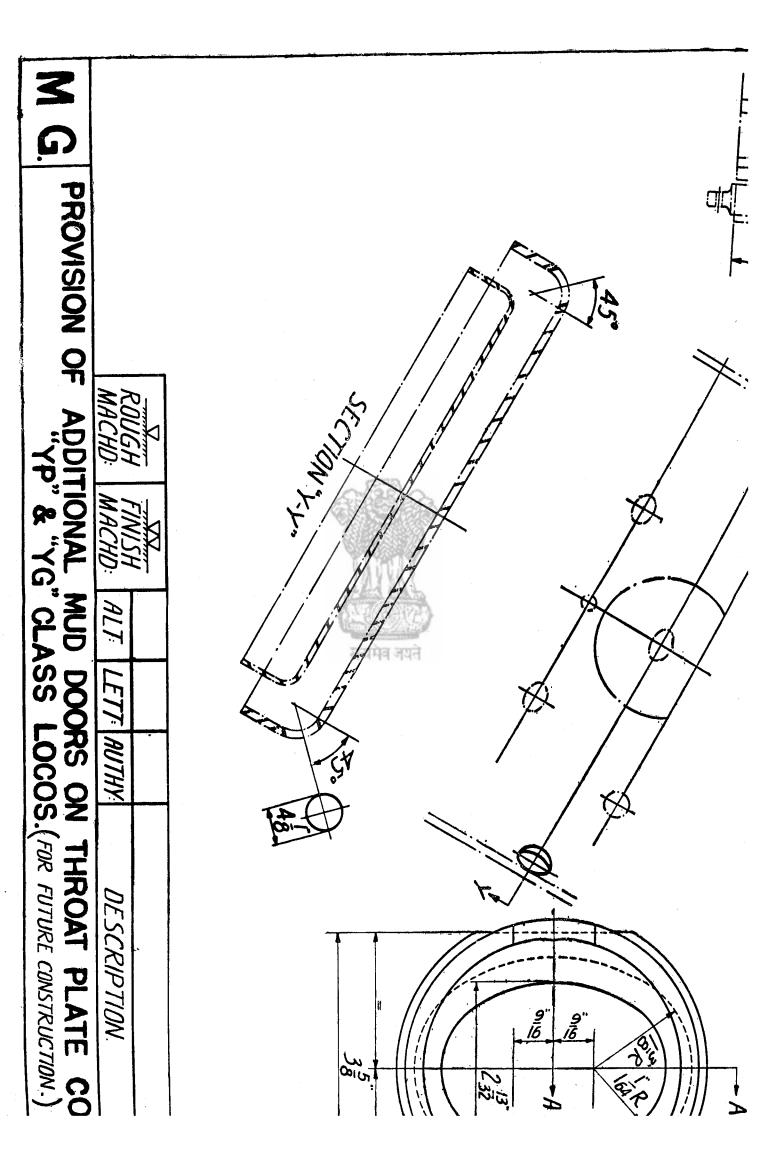


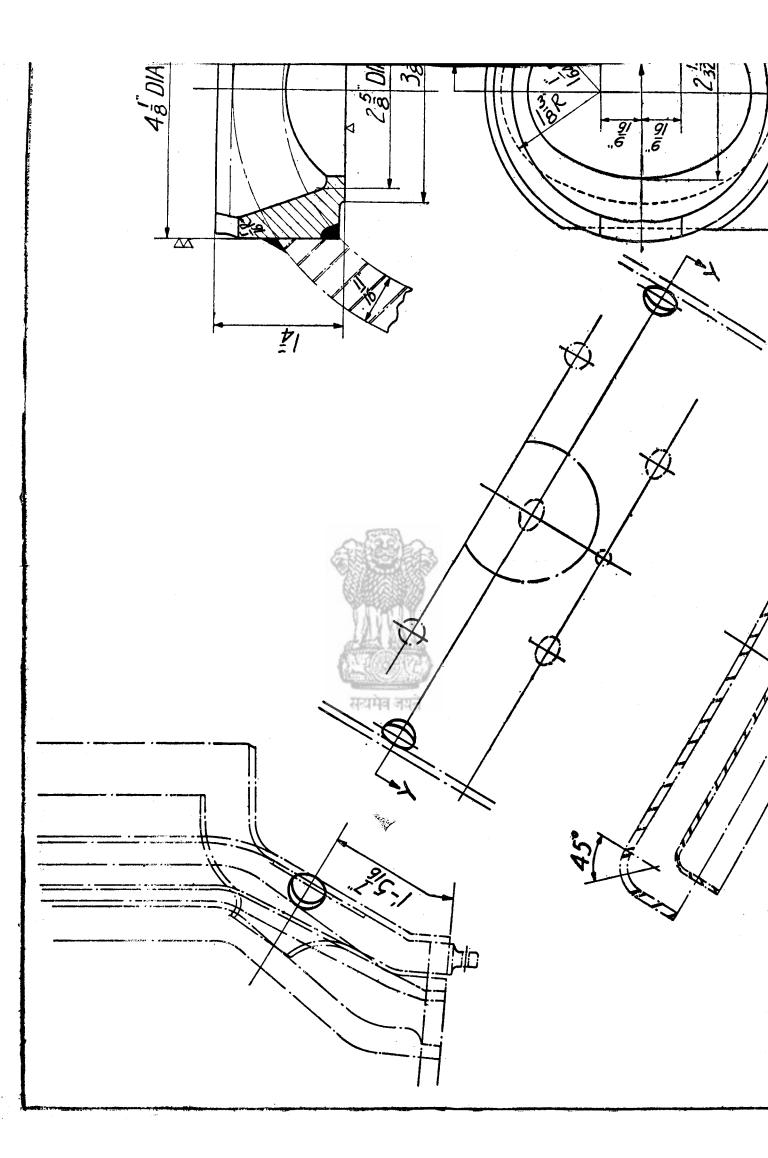


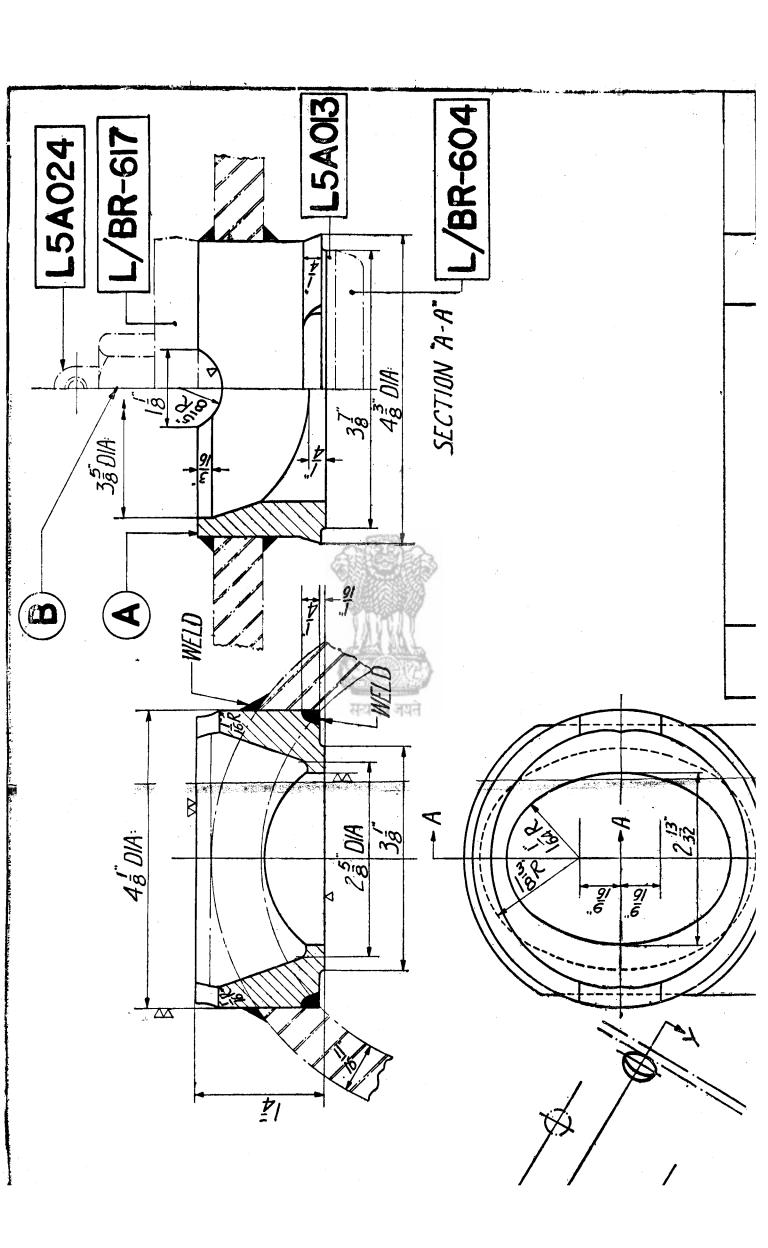


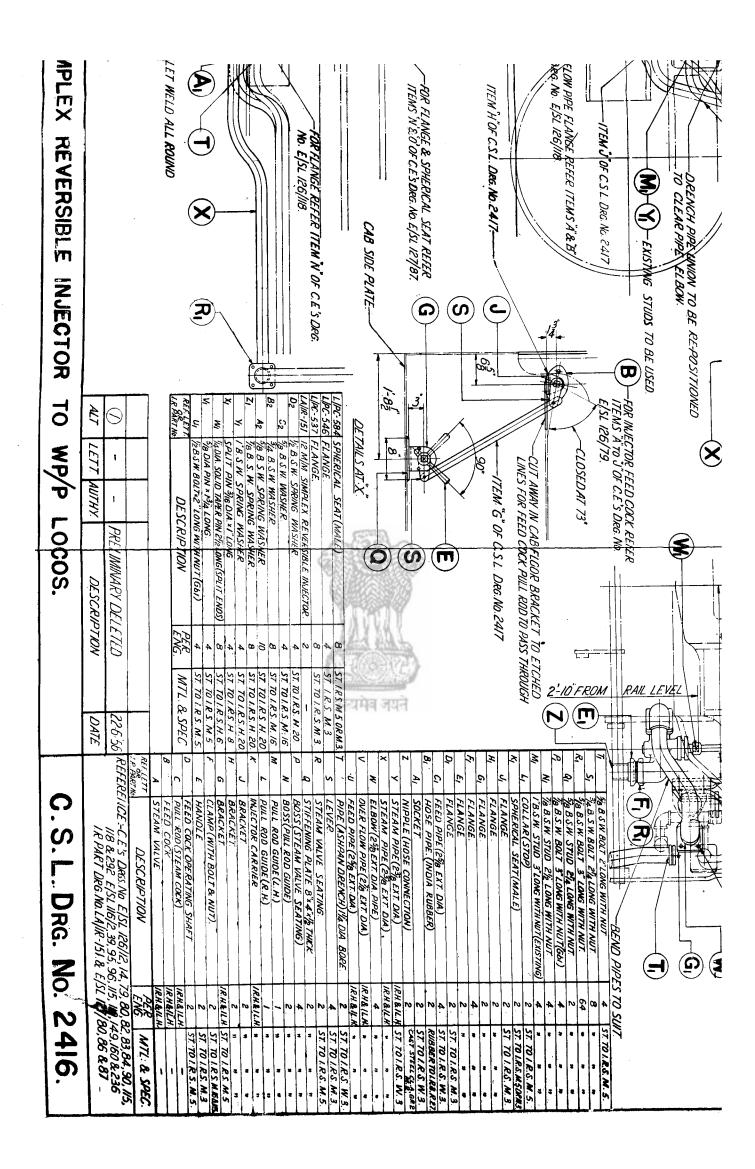


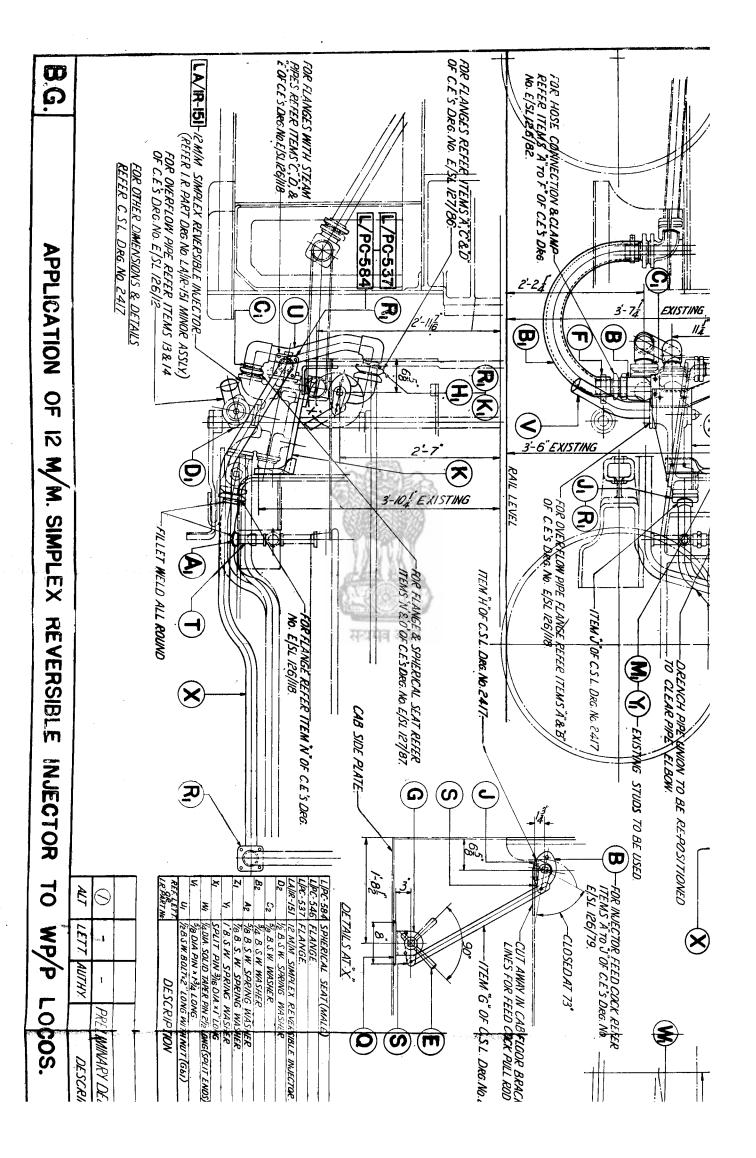


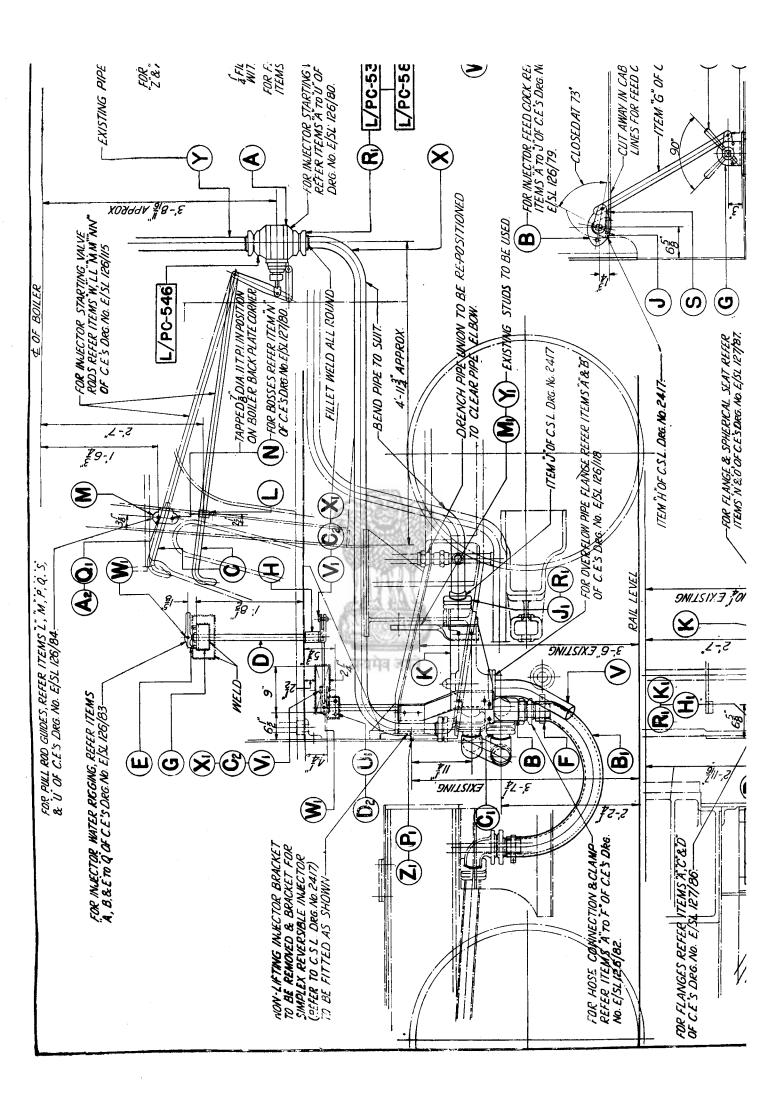


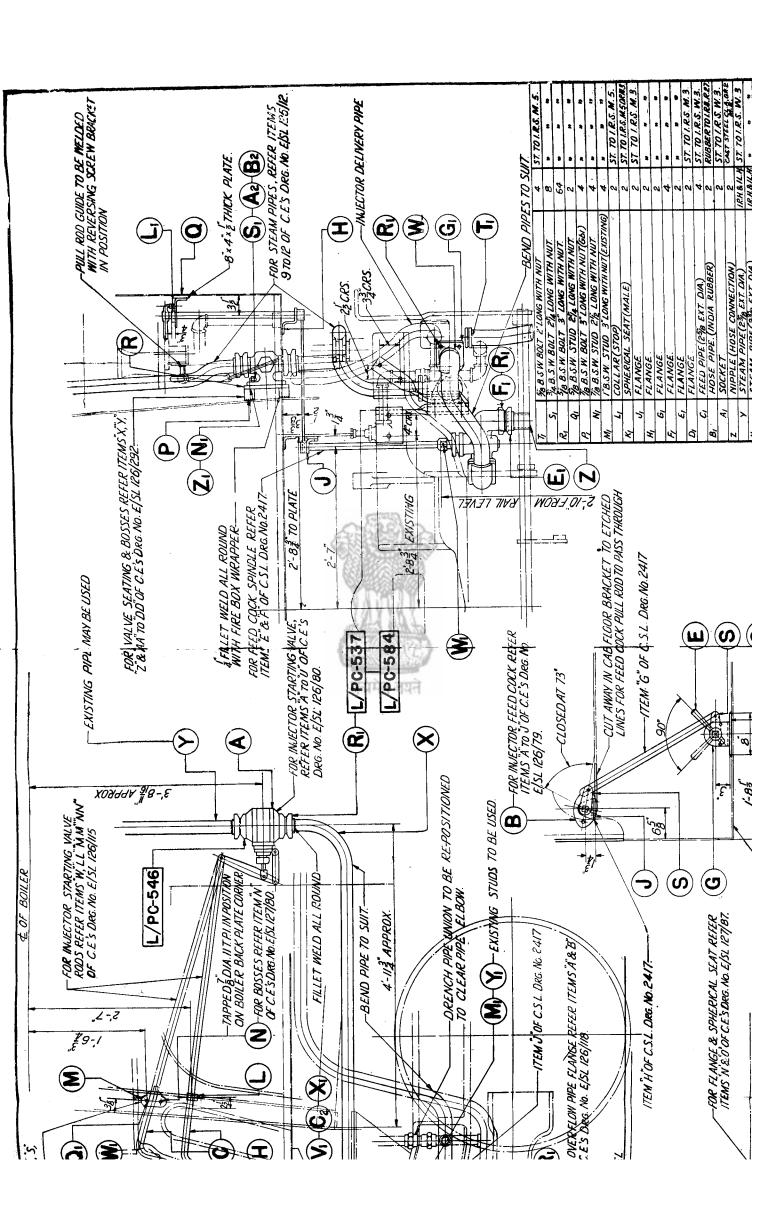


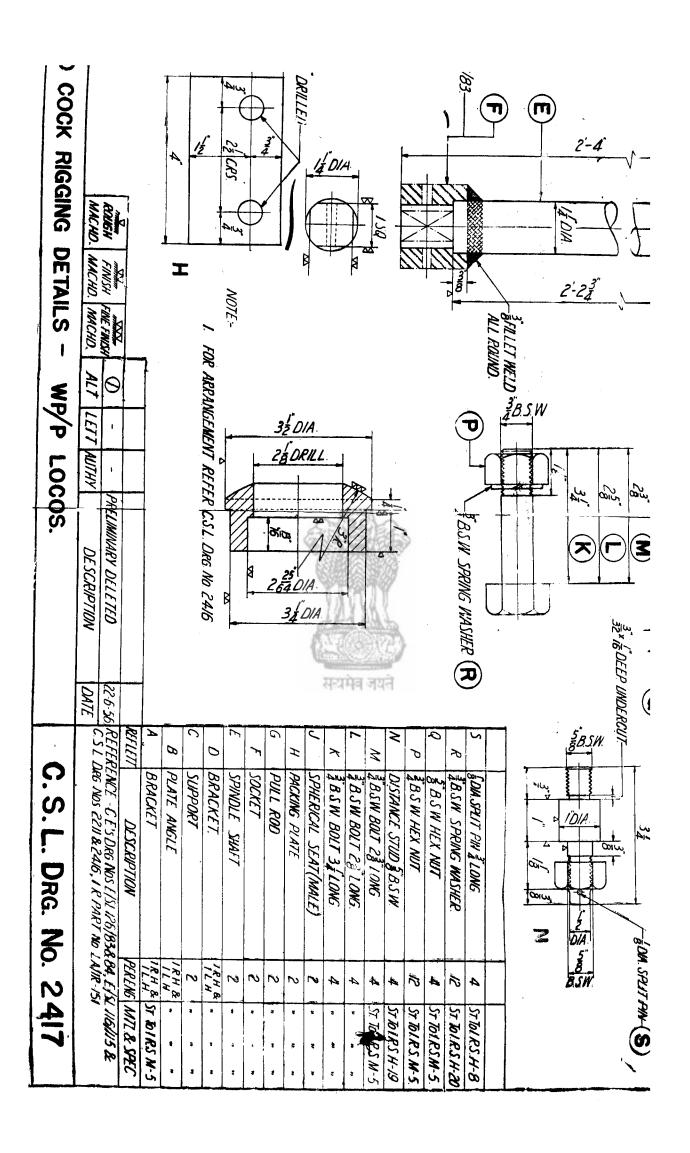


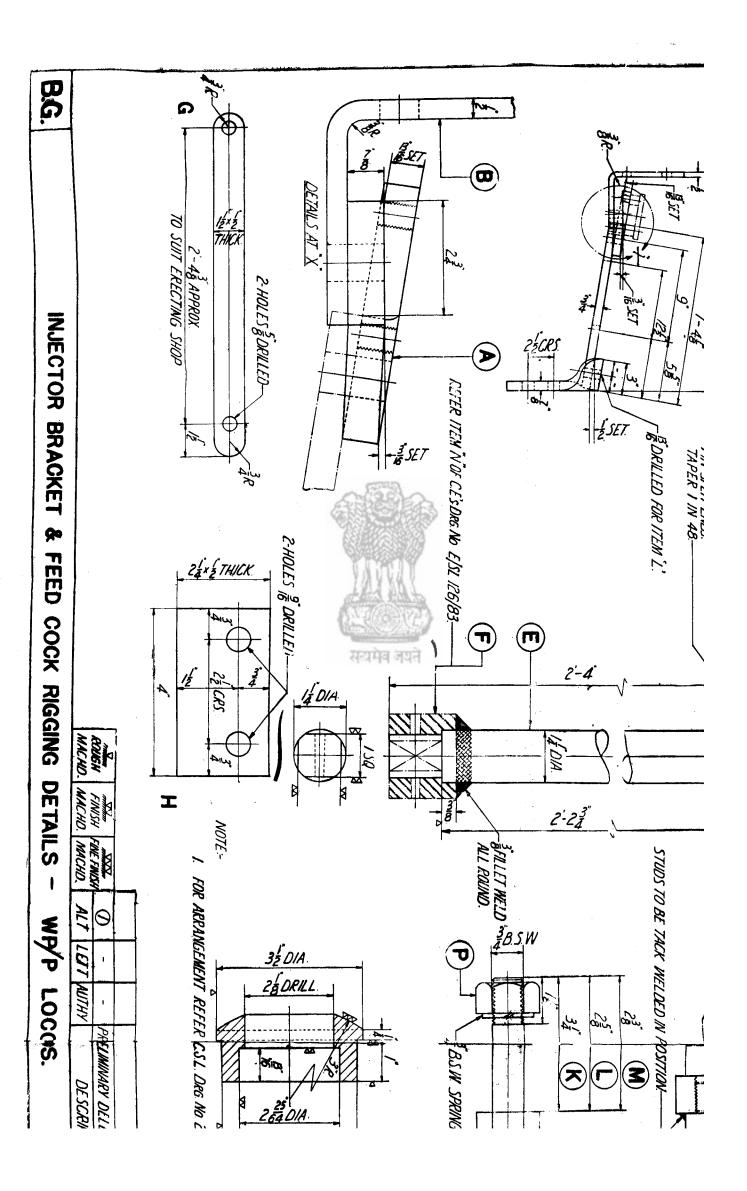


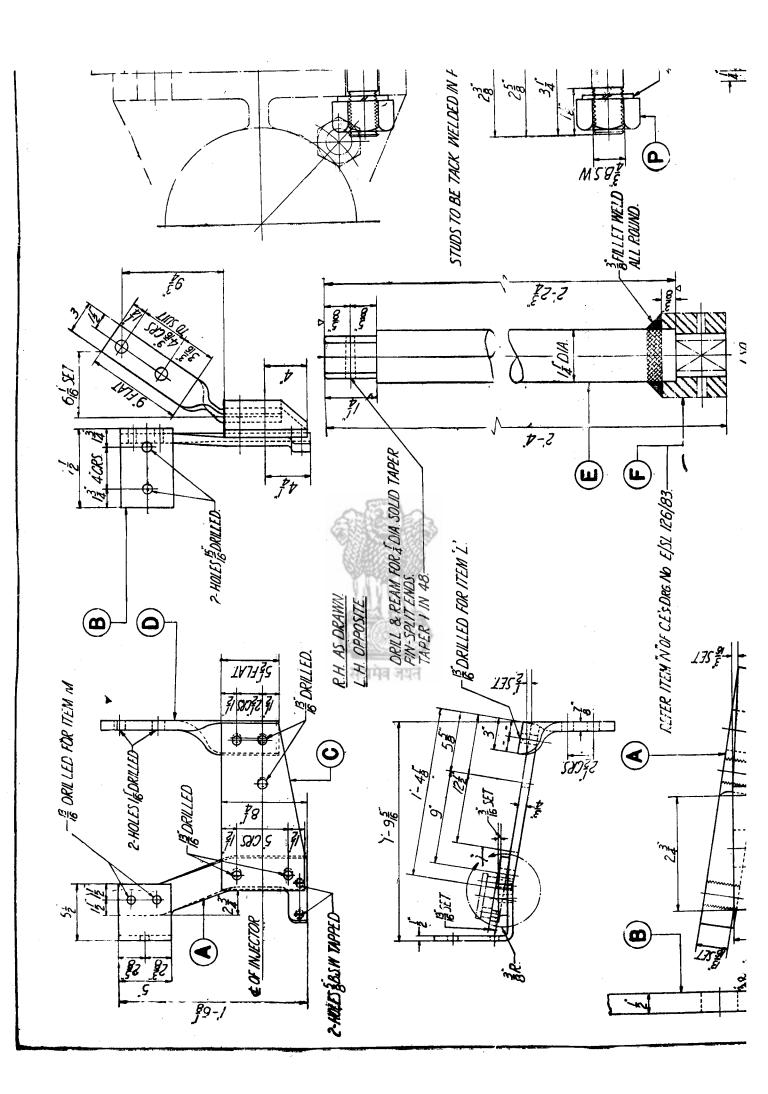


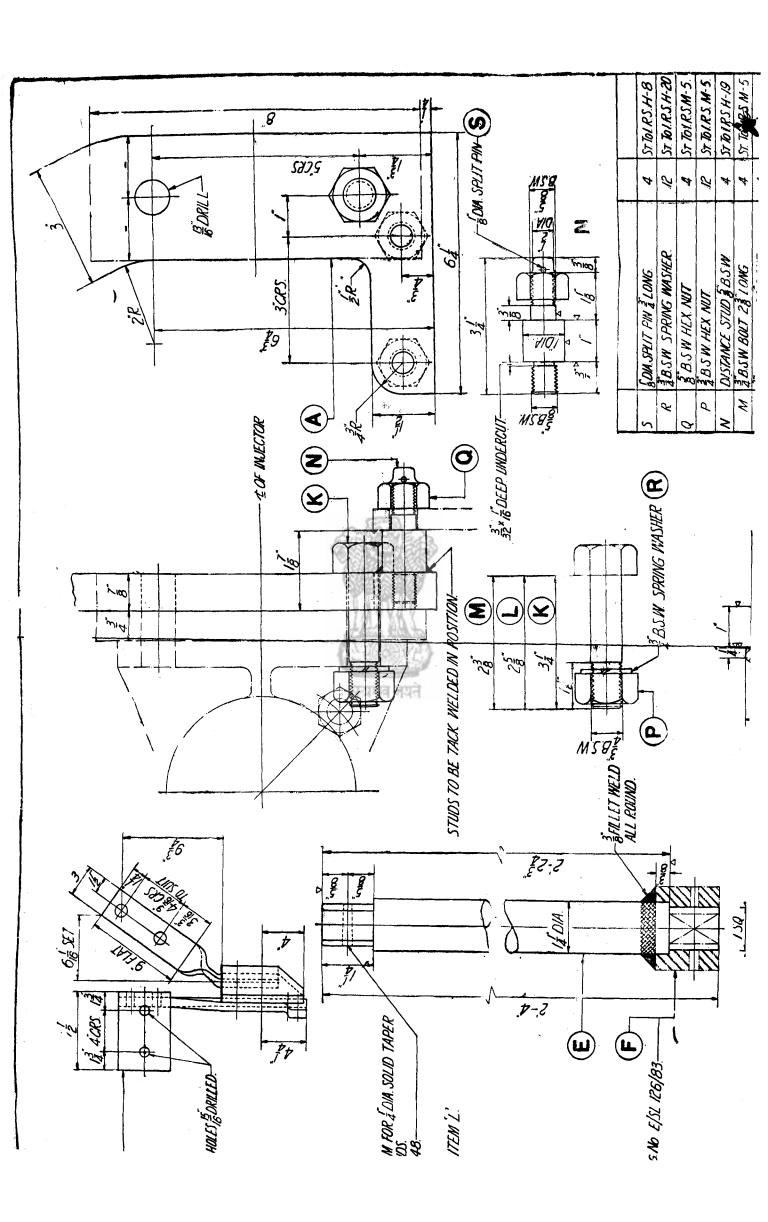










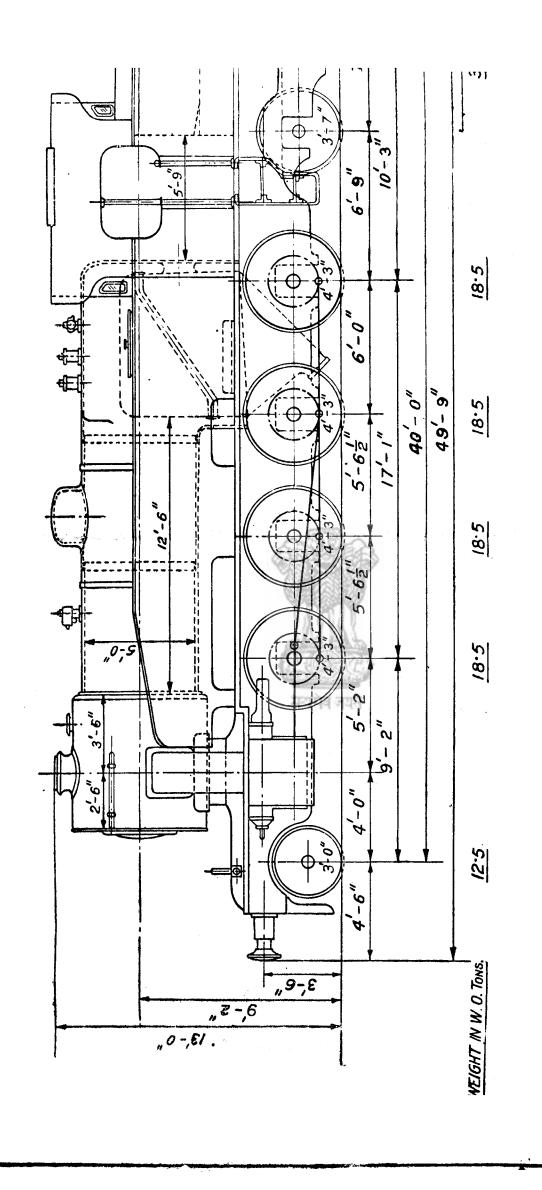


TYPE "WH" CLASS		CKGEAR							TANKS EMPTY.			TOR (5) WHEN	OR (5) IN W.O.	0.		STROKE	9" 5 18.5
H <sub>"</sub> CL/		82%MIN	N/L	14.	ØI- 10	WALSCHAERTS			3.96	4.45	60000	20500	33200	37200	4'-3"	201×26	
ASS LOCO FOR SHUNTING							MIN. WATER CAPACITY IMPERIAL GALLONS.	MIN. COAL CAPACITY LONG TONS.	MAX. WT. PER FT. RUN DVER BUFFERS.	MAX. WT. PER FT. RUN OF COUPLED WHEEL BASE.	MAX. WT. PER FT. RUN OF TOTAL WHEEL BASE.	MAX. WT. PERFT. DIA. ON A PAIR OF WHEELS.	MAX. WEIGHT ON A PAIR OF WHEELS.	MAX. WEIGHT ON COUPLED WHEELS.	ESTIMATED WEIGHT OF ENGINE EMPTY.	ESTIMATED WEIGHT OF ENGINE IN W.O.	32.0
SERVICE	RE	9					4000	8.5	2.38 Tows.	4.35 Tows.	2.96Taus.	4.35 Taws.	18.5 Tows.	74 Tows.	87.5 Tows.	118.5 Tows	
CE C.S.L. Drg. No. 2441	REFERENCE:-	COER REVIS							/o-o"	39/12, 9-15		4*			)		्राठ-०° च
11.	216	7477									٠						

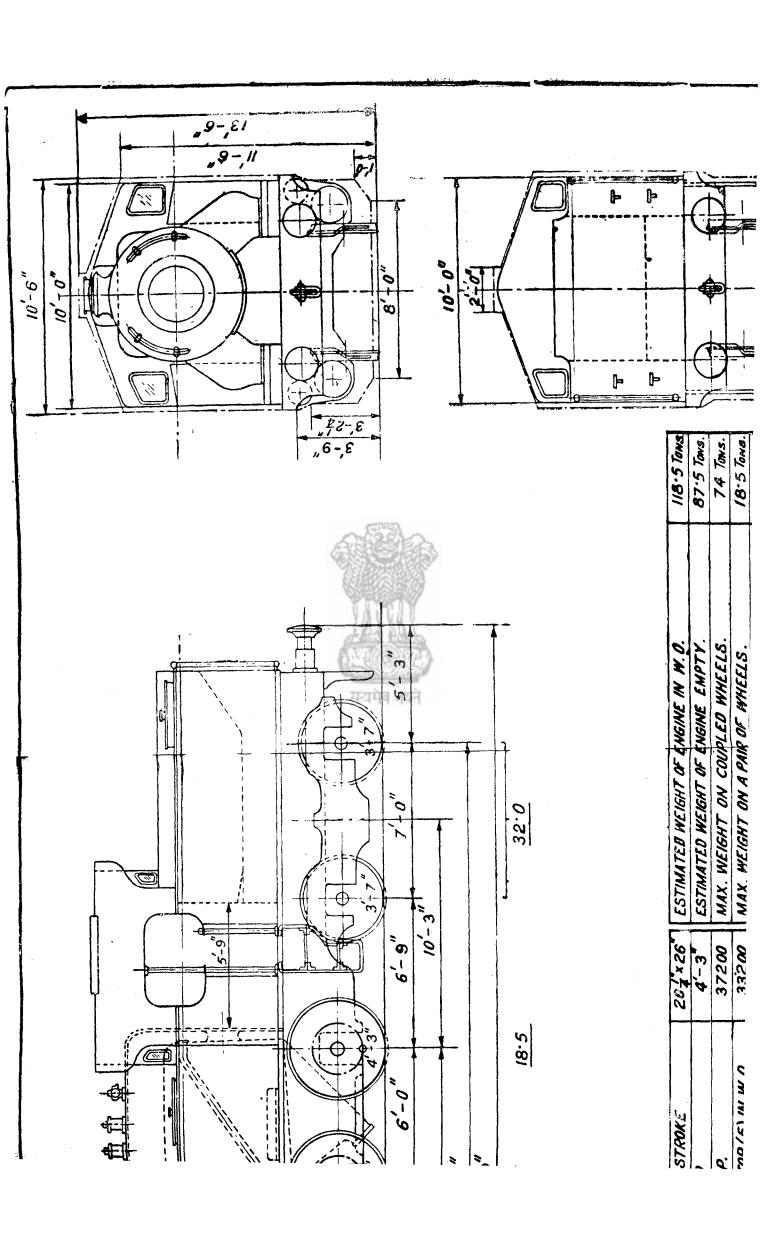
18:5	18:5	18.5
12:5		18.5
	18.5	7

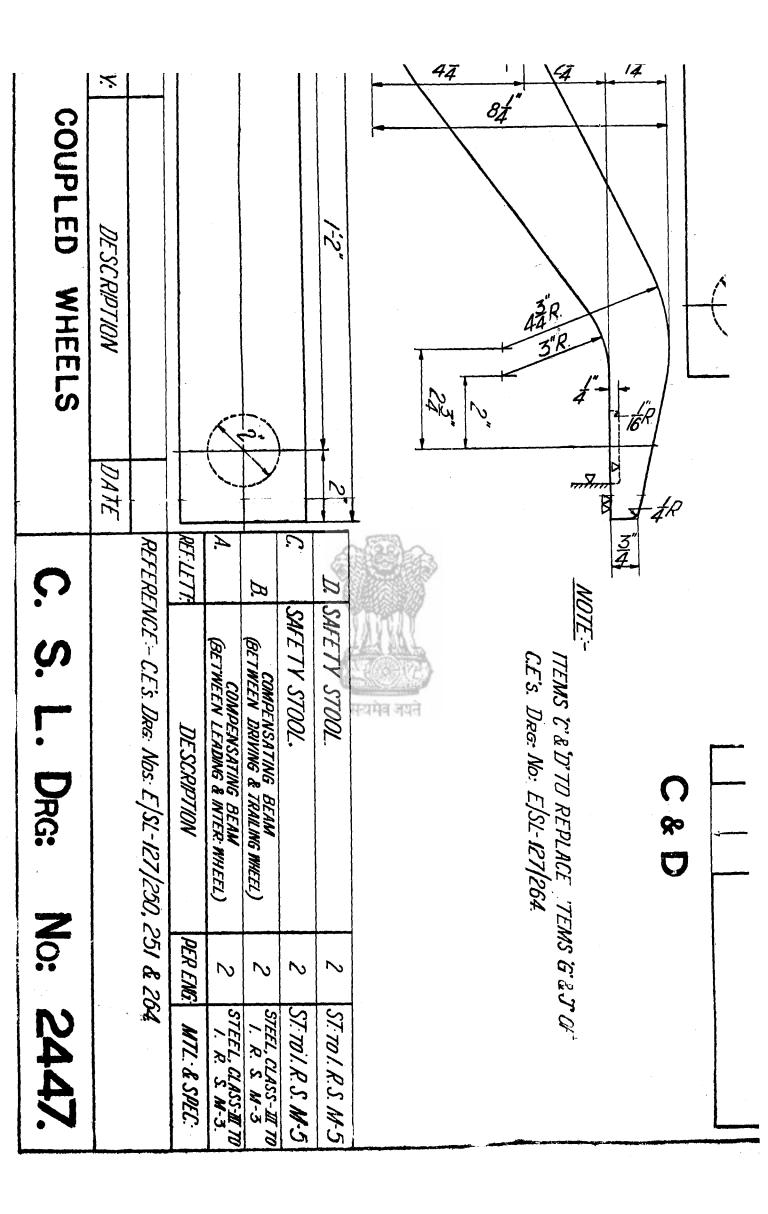
18.5

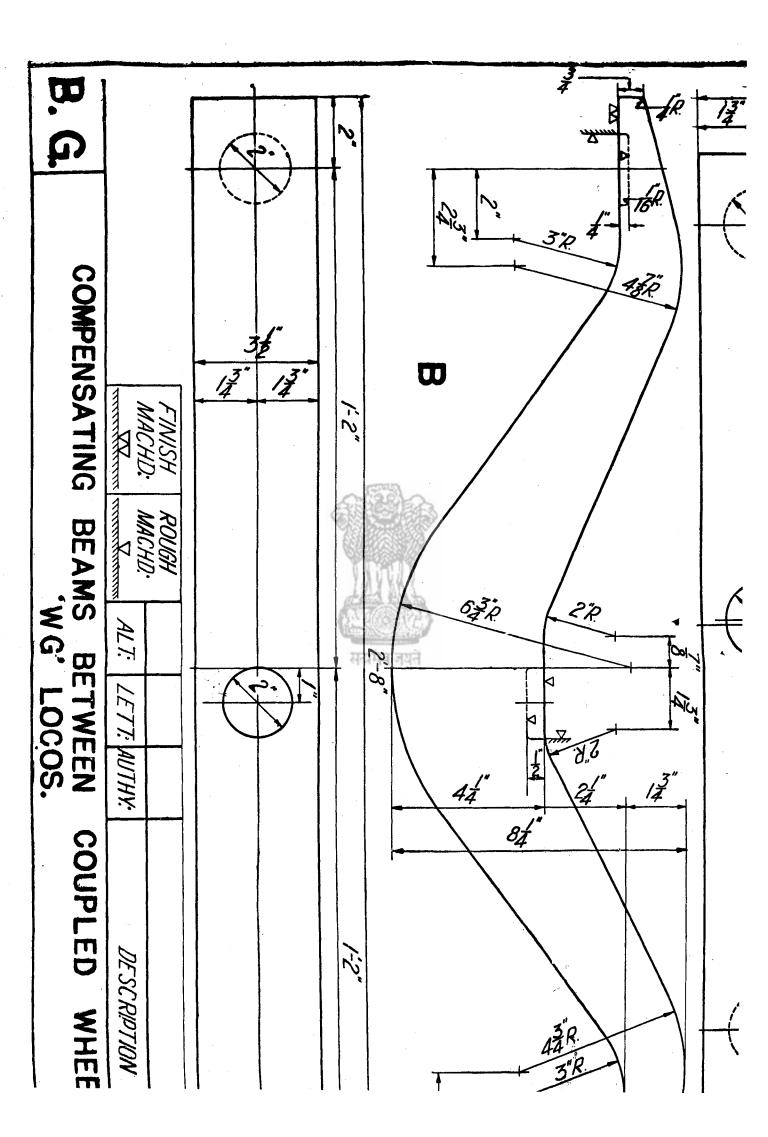
188	H"CLA	BG TENTATIVE DIAGRAM OF PROPOSED 2-8-4 TYPE "WH" CLASS	OF PF	TIVE DIAGRAM	BG TENT
N. S. C. C. S.					
· ·					
					:
	82%MIN	MAX. CUT OFF IN FORE OR BACK GEAR			
	WIL	EXHAUST CLEARANCE.			
	12	WIDTH OF STEAM PORTS.			
	14	VALVE LAP .	143	U.FT.	FIREBOX VOLUME CU.FT.
	ð∵"	VALVE LEAD.	27	7.	GRATE AREA SQ. FT.
	10"	PISTON VALVE DIA.	1483	PREACE SQ. FT.	TOTAL HEATING SURFACE SQ. FT.
	WALSCHAERTS	VALVE GEAR.	322	HEATING SURFACE SUPERHEATER SQ.FT.	HEATING SURFACE .
MIN. WATE			1161	TOTAL EVAPORATIVE HEATING SUPFACE SQ.FT.	TOTAL EVAPORATIVE
MIN. COAL			145	FIRE BOX SQ.FT.	HEATING SURFACE FIRE BOX SQ.FT.
MAX. WT. F	3.96	FACTOR OF ADHESION WHEN SIDE TANKS EMPTY.	16	HEATING SURFACE ARCH TUBES SQ. KT.	HEATING SURFACE
MAX. WT. P	4.45	FACTOR OF ADHESION IN W.O.	445	FLUES. SQ. FT.	HEATING SURFACE FLUES. SQ. FT.
MAX. WT. P	2000	SIDE TANKS EMPTY.	555	TUBES SQ.FT.	HEATING SURFACE TUBES SQ.FT.
MAX. SYT.	20500	T.E. AS LIMITED BY ADHESION FACTOR (5) WHEN	) 26×13"	SUPER HEATER ELEMENTS A TYPE Nº x0.S.DIA. (95.WG)	SUPER HEATER EL
MAX. HEIG	33200	T.E. AS LIMITED BY ADHESION FACTOR (5) IN W.O.	S×S″	ARCH TUBES NES × O.S. DIA. (7 S. W.G.)	ARCH TUBES NOS
MAX. WE16	37200	TRACTIVE EFFORT AT 85% B.P.	26×5/ "	. DIA. (8S.W.G.)	FLUES NOS X O. S. DIA. (85.W.G.)
ESTIMATED	4'-3"	DIA. OF COUPLED WHEEL ON TREAD	85×2"	.DIA. ( II S.W.G.)	TUBES NOS X O. S. DIA. ( II S.W.G.)
ESTIMATED	201×26	CYLINDERS(2) O.S. BORE * PISTON STROKE	210	'&S. /SQ. IN.	BOILER PRESSURE LES. / SQ. IN.

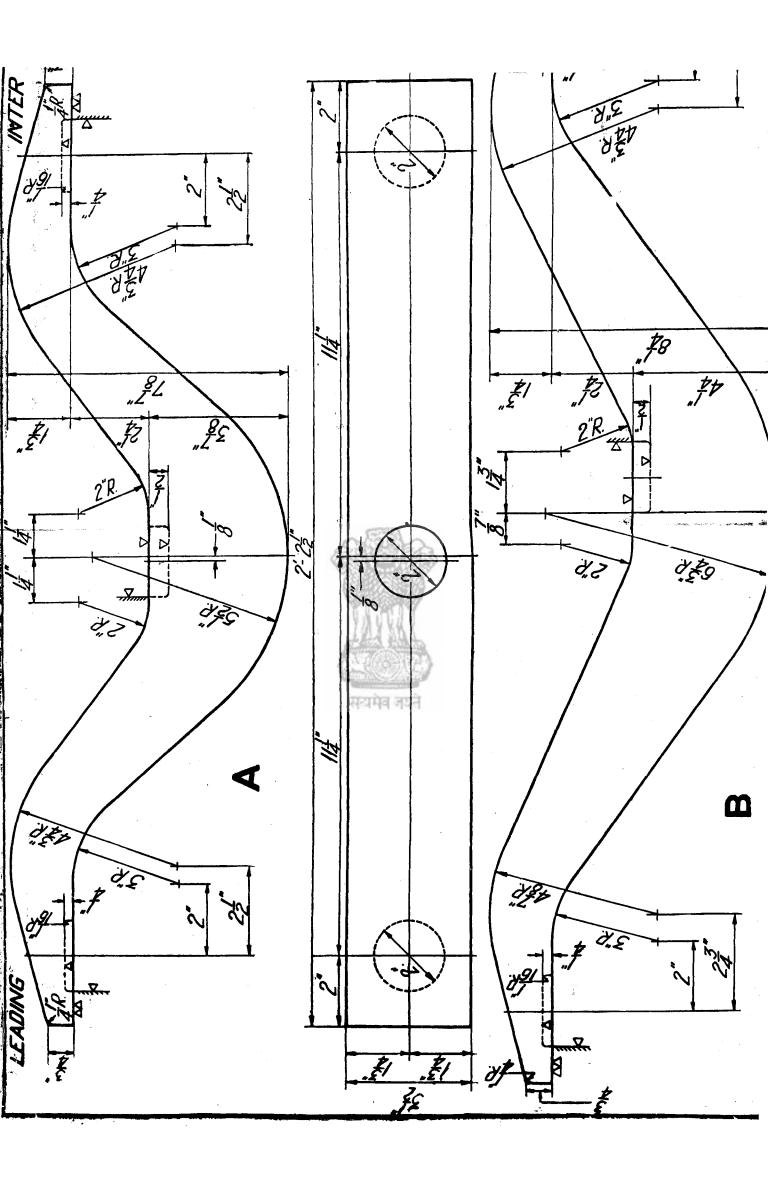


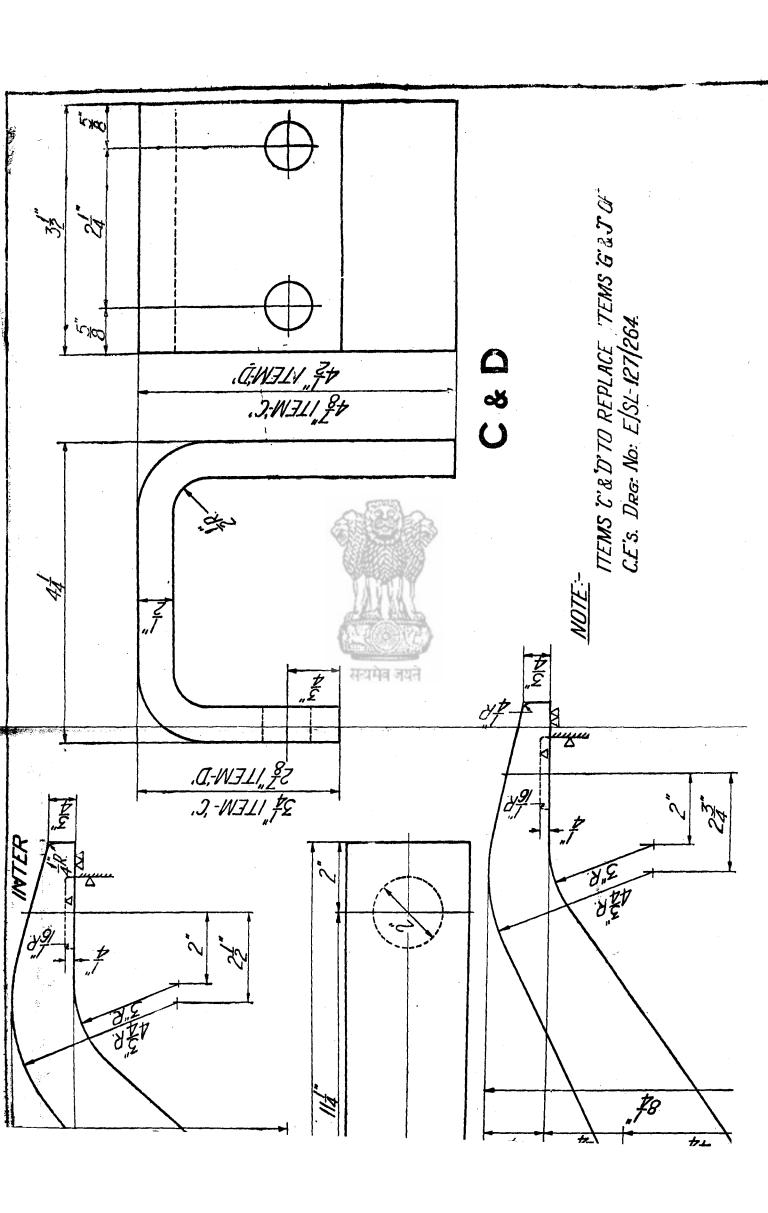
BOILER PRESSURE LBS. / SQ. IN.	510	CYLINDERS(2) 0.5. BORE × PISTON STROKE	204×26	264 x 26 ESTIMATED
TUBES NOS X 0. S. DIA. ( 11 S.W. G.)	85x2"	DIA. OF COUPLED WHEEL ON TREAD	4'-3"	4'-3" ESTIMATED
FLUES NOS X O. S. DIA. (8S.W.G.)	26×5¥″	TRACTIVE EFFORT AT 85% B.P.	37200	37200 MAX. WE16
		1		II

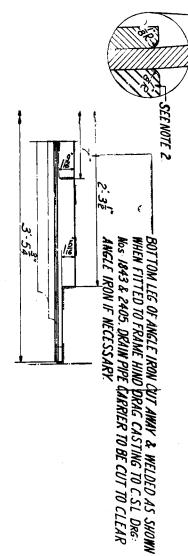












NOTE-

- ALL SHARP EDGES OF BREATHING PLATE TO BE ROUNDED OFF.
- SHARP CORNERS OF LINERS. CASTING & ANGLES IN CONTACT-WITH BREATHING & ALL DEFLECTION PLATES TO BE ROUNDED OFF
- WHEN BREATHING PLATES WITH LINERS (ITEM B) TO THIS DRG ARE FITTED TO WP LOCOS MAKERS No. 74294 TO 74333, 77200 & 77201, BOLTS TO ITEM U'OF DRG: No E/SL-126/150 SHOULD BE FITTED.

w

WHEN LOCOS: ARE FITTED WITH BREATHING PLATE TO THIS DRG: EXISTING GRATE SHAKER LEVER POCKETS ATTACHED TO ASH PAN SHOULD BE REMOVED 4 COVER PLATE TO C.S.L.Drg: No: 2459 FITTED

4

HIND CENTRE FIRE BAR CARRIER I.R PART No. 1./FG -608 TO BE MODIFIED.

Ś

- 6. TWO HOLES IB DIA: ARE REQUIRED ONLY WHEN THE ASH PAN DREWCH ARRGIS: ARE TO DRG NOS: E/SL-126/53 & E/SL-127/48.
- (2) 7 NOTE No. 4 DOES NOT APPLY TO NEW BUILDS WHERE ASHPANS ARE SUITABLY MODIFIED

S S

So

FRAME DEFLECTION PLATES - "WG" & "WP" LOCOS

MACHD

1137

AUTHY

DESCRIPTION

C S

L. DRG. No. 2458

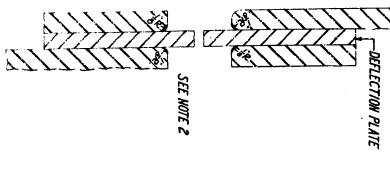
J.S. L-861. NOTE 7 ADDED

TEMBOR REVISED & RETRACED

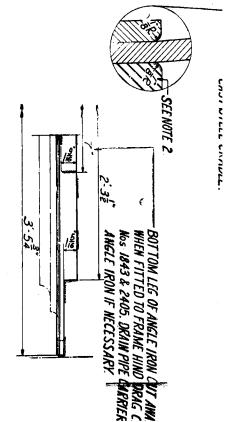
OW	:00	11 10		
			3	
		rana	J Z ( ) V Ne ovi nama ani	मुख्य होता. स्थापन नार्यः

-					
043 6.2403;	1040.10	DATE.   175M-6 OF XXXVI L S.C. DRG NOS 1040, 1042 4. 2403		DATE.	
149,1514152.	141,148,	RENCE -E/SL 126/14; 142,149 & 150. E/SL 127	REFE	3/56.	
PERENG MIL & SPEC	PER ENG.	DESCRIPTION	REF LE	2/57 REFLETT	
STallmIRSM-5	/	BREATHING PLATE	A		
:	1	B LINER			
ST (I: II rol RS #5	1	ANGLE IRON	C		
5 ST CI-MTTOLRS W8	5	D ZDIA RIVETS			
1 STATE TOLKS N.S.	1 6	ANGLE IRON	£.		

HOLES SHOWN THUS - SHOULD BE MARKED OFF FROM FOUNDATION RING & CRADLE CASTING & DRILLED TO SUIT I DIA: TAPERED FITTED BOLTS FOR WG. WP & TO SUIT I DIA: STRAIGHT FITTED BOLTS FOR WG.







NOTE-

- ALL SHARP EDGES OF BREATHING PLATE TO BE ROUNDED OFF.
- SHARP CORNERS OF LINERS, CASTING & ANGLES IN CONTACT-WITH BREATHING & ALL DEFLECTION PLATES TO BE ROUNDED OFF
- WHEN BREATHING PLATES WITH LINERS (ITEM B) TO THIS DRG ARE FITTED TO WP LOCOS MAKER'S No. 74294 TO 74333, 77200 & 77201, BOLTS TO ITEM U OF DRG: No E/SL·126/I50 SHOULD BE FITTED.
- WHEN LOCOS: ARE FITTED WITH BREATHING PLATE TO THIS DRG: EXISTING GRATE SHAKER LEVER POCKETS ATTACHED TO ASH PAN SHOULD BE REMOVED & COVER PLATE TO C.S.L.Drg: No. 2459 FITTED
- HIND CENTRE FIRE BAR CARRIER I.R PART No. L|FG-608 TO BE MODIFIED.
- 6. TWO HOLES IN DA: ARE REQUIRED ONLY WHEN THE ASH PAN DRENC ARRESTS: ARE TO DRG: MOS: E/SL-126/53 & E/SL-127/48.

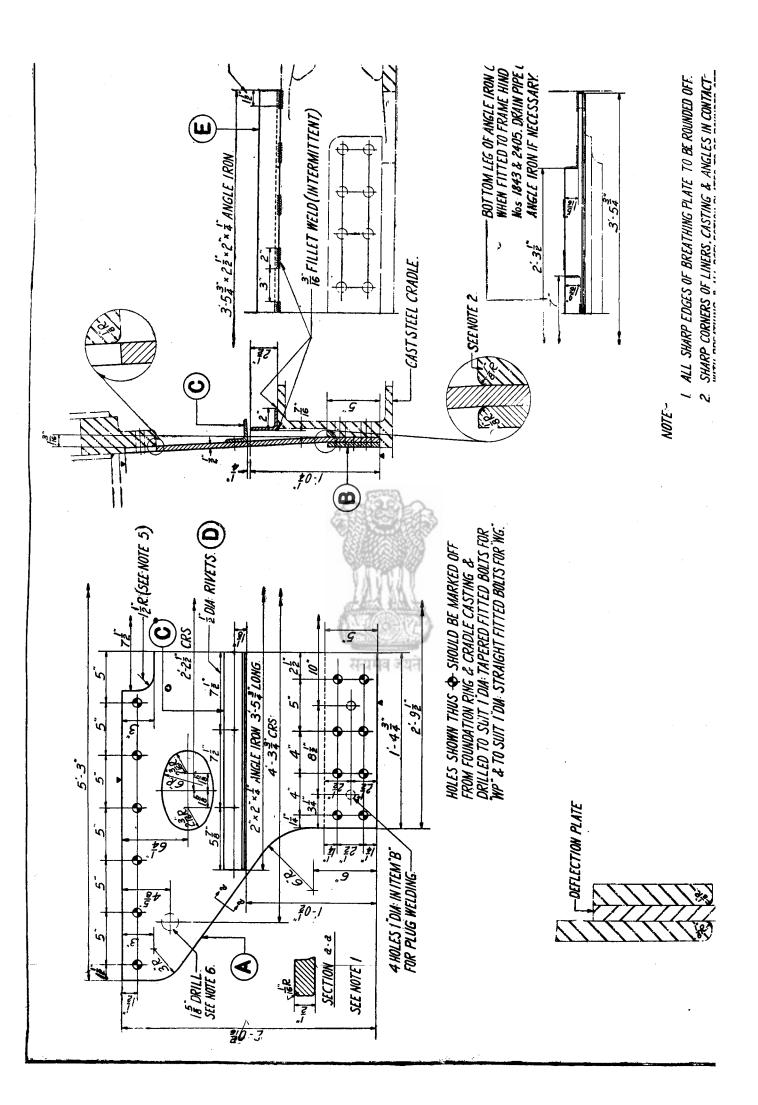
  (2) 7 NOTE No: 4 DOES NOT APPLY TO NEW BUILDS

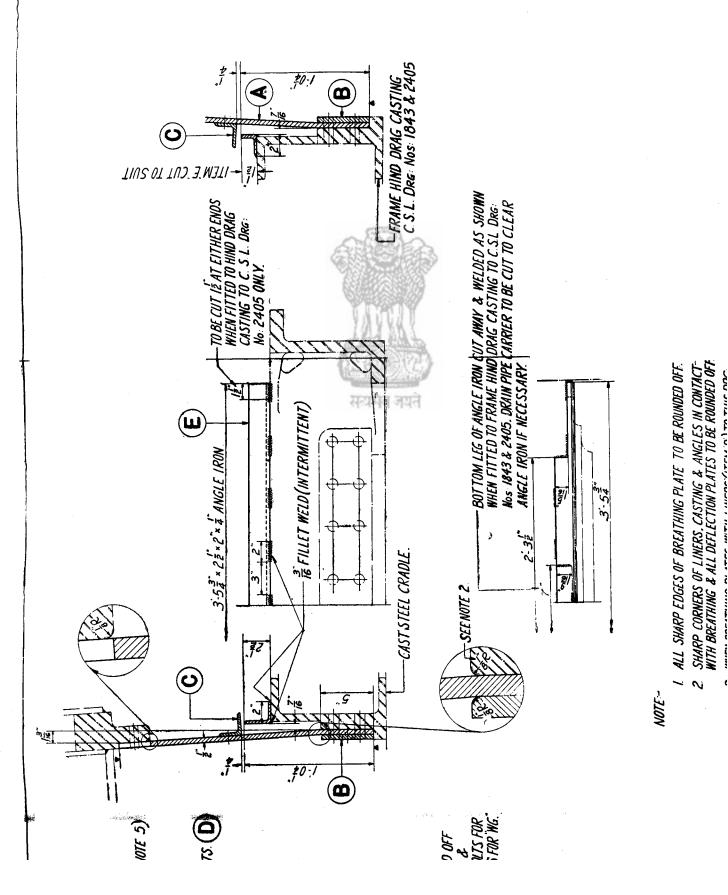
  NHERE ASHPANS ARE SUITABLY MODIFIED

MACHO	ROUGH	
ALT	0	0
LETT		1
AUTHY	ITEM 8 OF	JS L-861 NOTE
	REVISED &	NOTE 7
ESCA	FTRAC	azac

MODIFICATION TO BOILER BREATHING & FRAME DEFLECTION PLATES - "WG" & "WE" LO

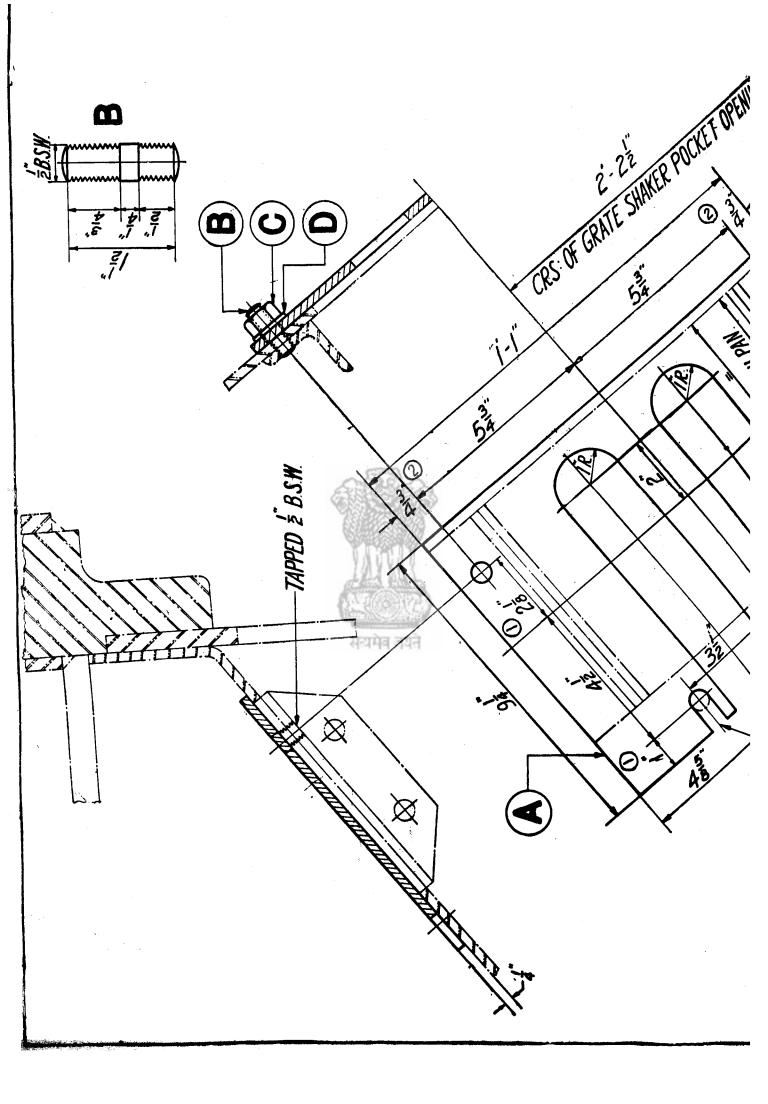
S B



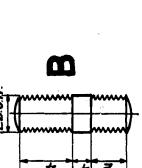


2459	No.	S. L. DRG.	C.	-"WG" & "WP" LOCOS.	N-,-
		2296, 2310 & 1/C DRG NO SL/X9/MG-73.	DATE 2296, 23	DESCRIPTION.	AUTHY
DRG. Nos. 2295,	77428.CSL	REFERENCE - E/SL-126/49 & 50. E/SL-127/45, 6 MG 27 & 28. C.S.L. Dre. Mos. 2295,	10/55. REFEREN	28 WAS & I ADDED.	SI/WP/BR S No. 72
PER ENG. MTL: & SPEC.	PER ENG.	DESCRIPTION	12/55, REFLETT	DIMENSIONS ADDED.	SL/WP/BR S.No.74
ST. TO I.R.S. M-5.	2	CONER PLATE	2/57. A	J.S.L.86. NOTE MODIFIED 2	J.S.L.8u
8	4	½BSW STUD	8.	LH REVERSED	
ST. 70 1.R.S. M-5.	4	ZBSW NUT	2	COVER PLATE R.H. SHOWN	
B.S.S. 1083.	4	Z B.S.W. WASHER	D.		
		सन्यमेव जयने		S DRILL	
				AR CO LIND	
				d diwy	NIG
				37.59 37.495	
				W:302	(8)

EXISTING BOLTS MODIFICATION TO ASH PAN-"WG" & "WP" LO EXISTING OPENING IN ACH PAIN 32/2 ALT 0 LETT AUTHY SMINTAIN F TAY DOG AT ANNING THAT AN SAID SW. 72 25 ... WAS & 1 . MODED. SIMPLER DIMENSIONS ADDED. J.S.L.86! NOTE MODIFIED 図 LH REVERSED COVER PLATE R.H. SHOWN -16 DRILL DESCRIPTION



m

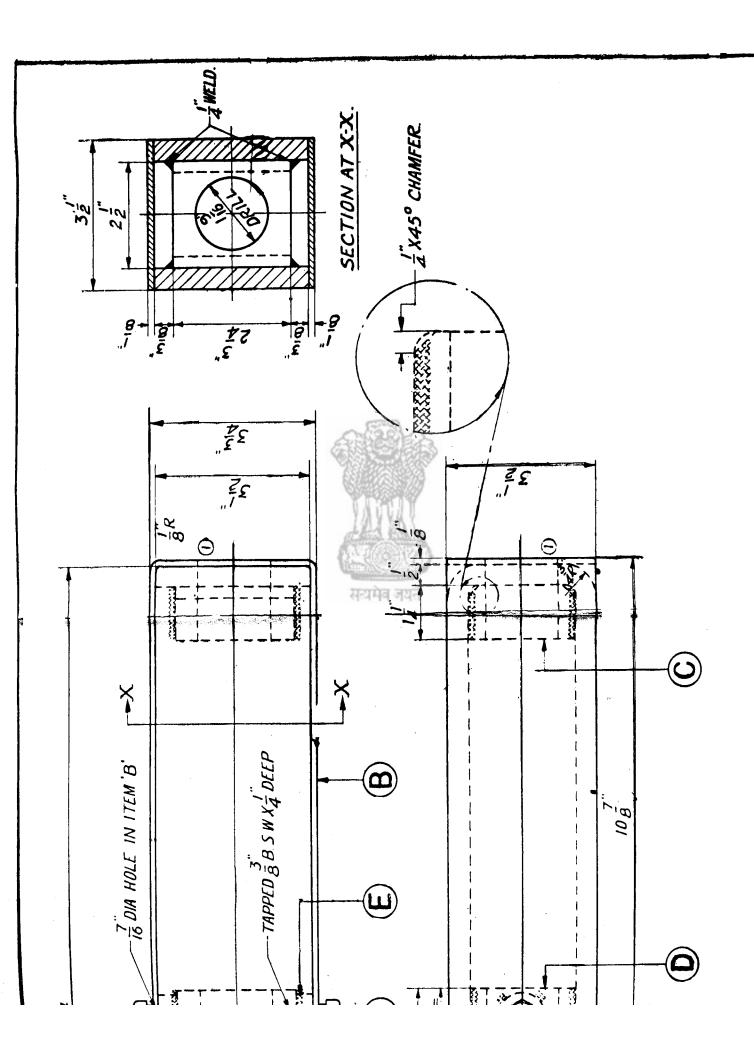


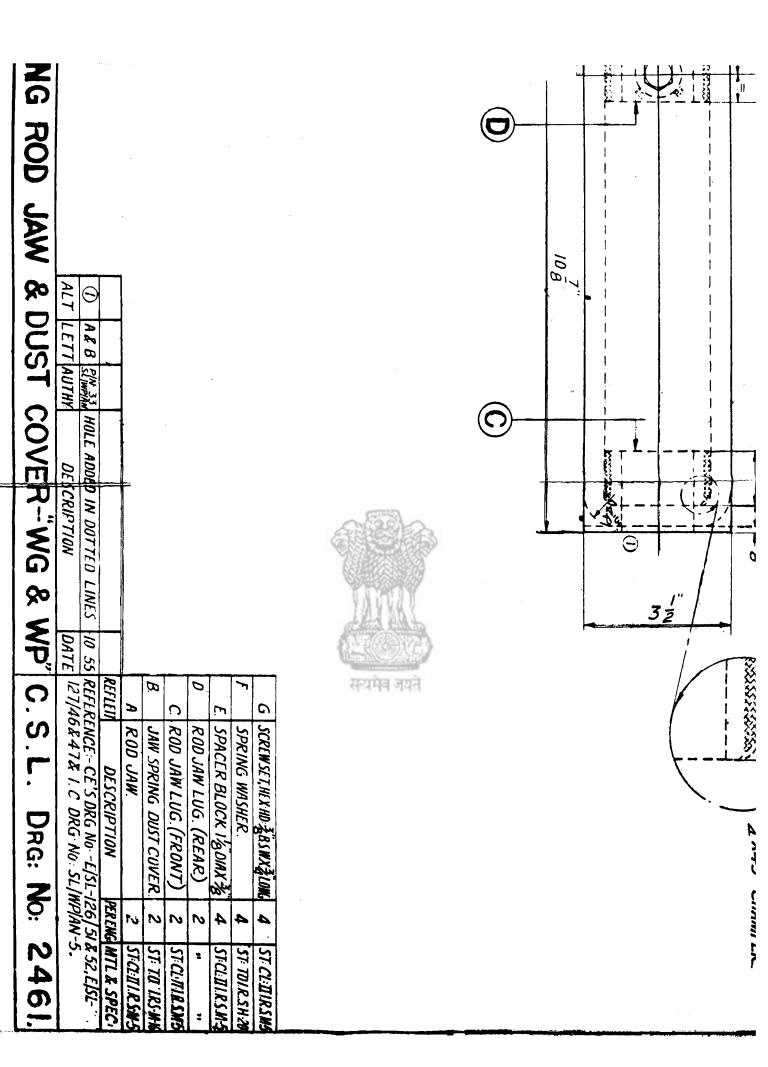


1. WHEN BREATHING PLATE TO C.S.L. DRG: NO: 2458 IS FITTED EXISTING COVER PLATES ARE TO BE FITTED TO TOP HOPPER IN THE CASE OF TWO PIECE ASH PAIN & TO HIND BAFFLE PLATE IN THE CASE OF GRATE SHAKER LEVER POCKETS ARE TO BE REMOVED AND

INE-PIECE A SH PAN.

2. THIS DRAWING DOES NOT APPLY TO LOCOSEFIT TED WITH MODIFIED ASHPAN WHERE-IN THE GRATE SHAKER LEVER POCKETS ARE ELIMINATED





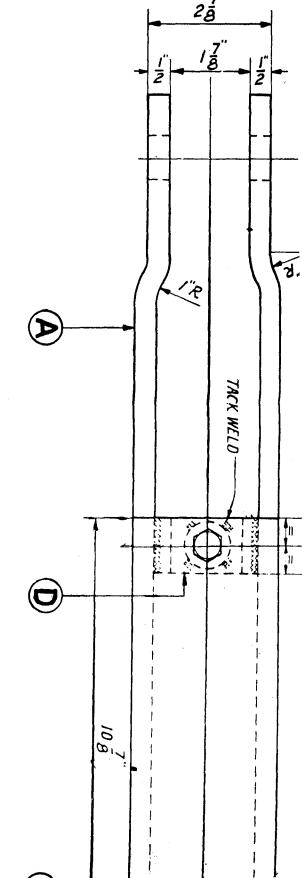
A & B SIMPIAN

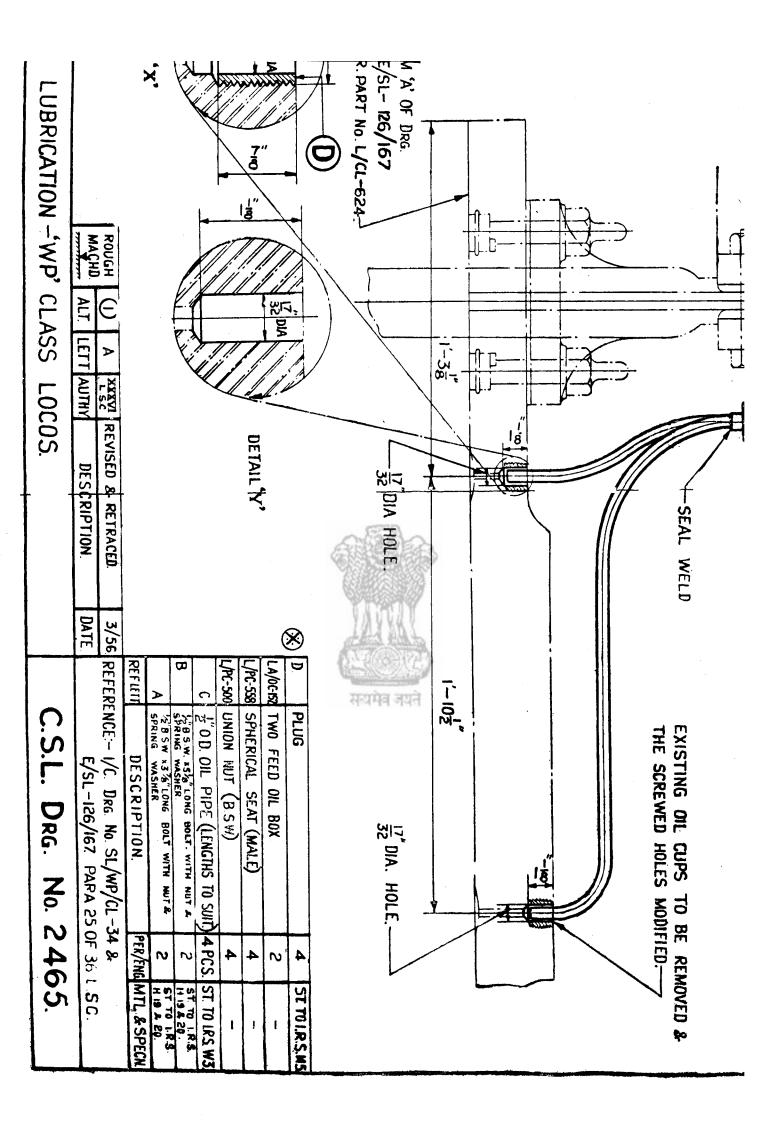
NOTE:
ITEMS A, B & C OF THIS DRAWING

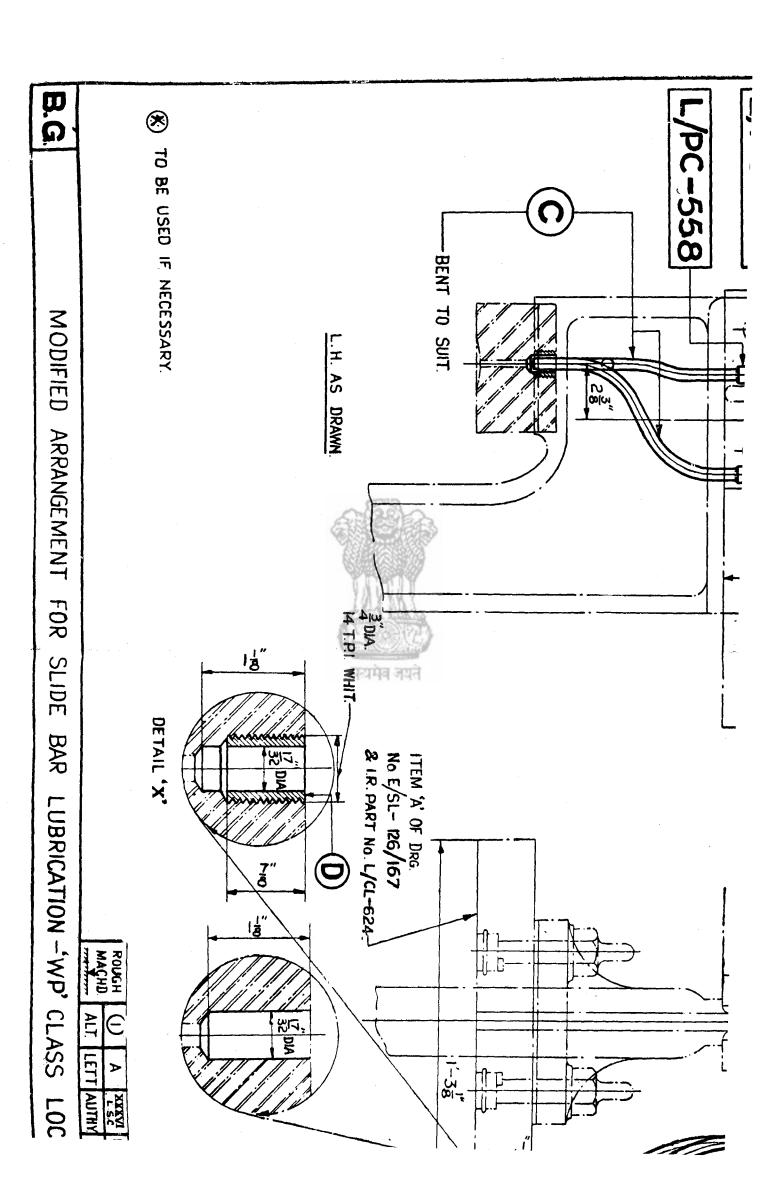
REPLACE CORRESPONDING ITEMS

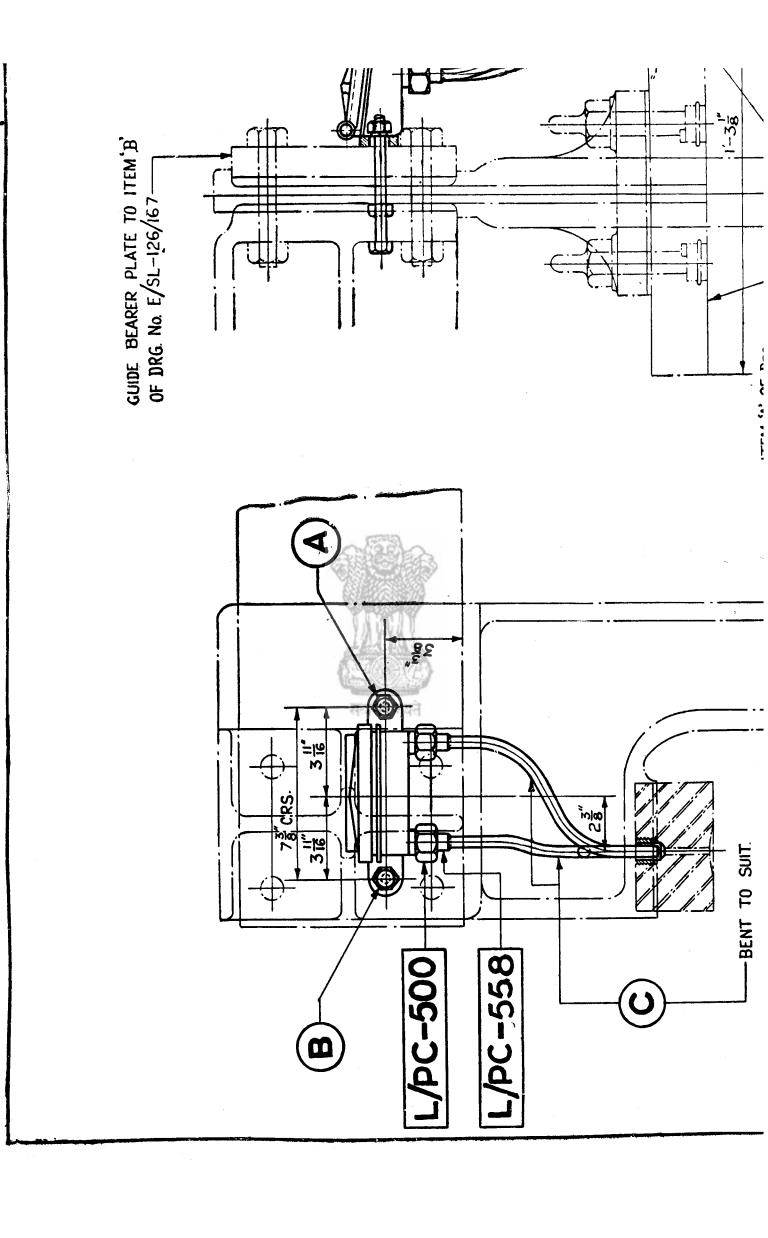
SHOWN ON CE'S DRG: NOS: E/SL-126/52
& E/SL-127/47.

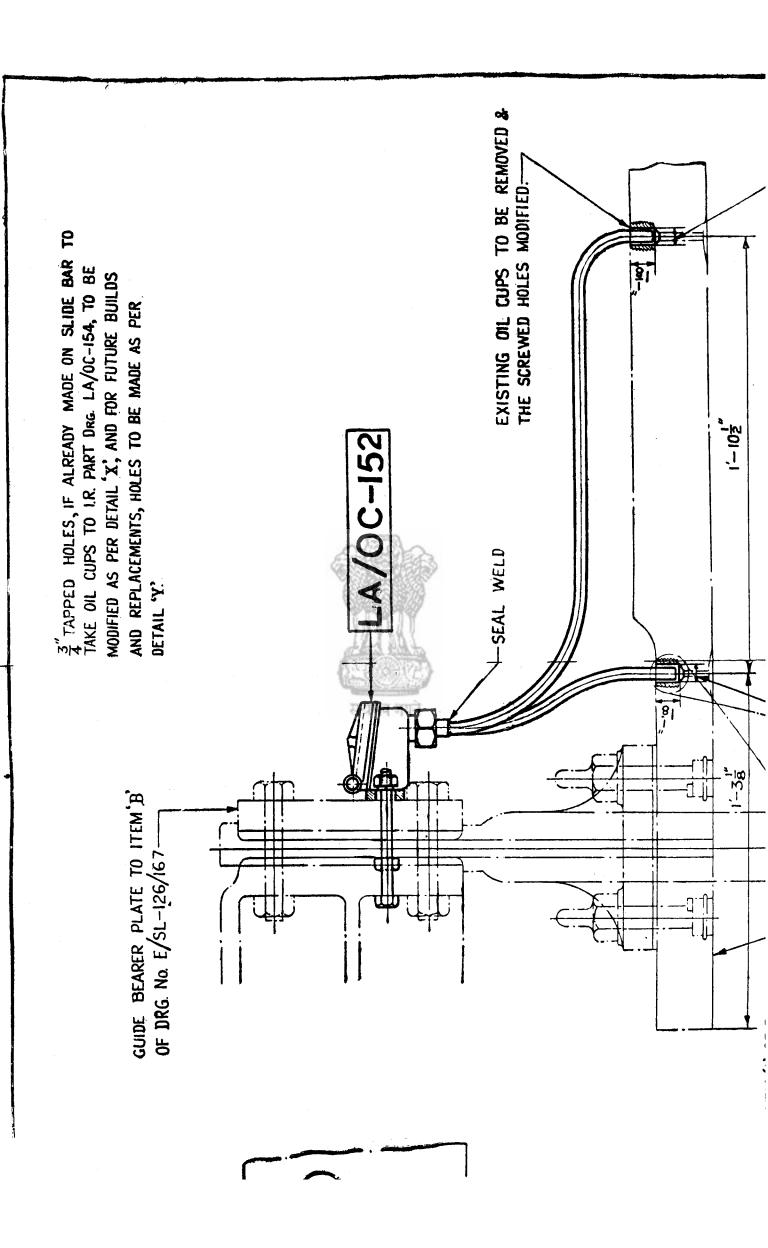


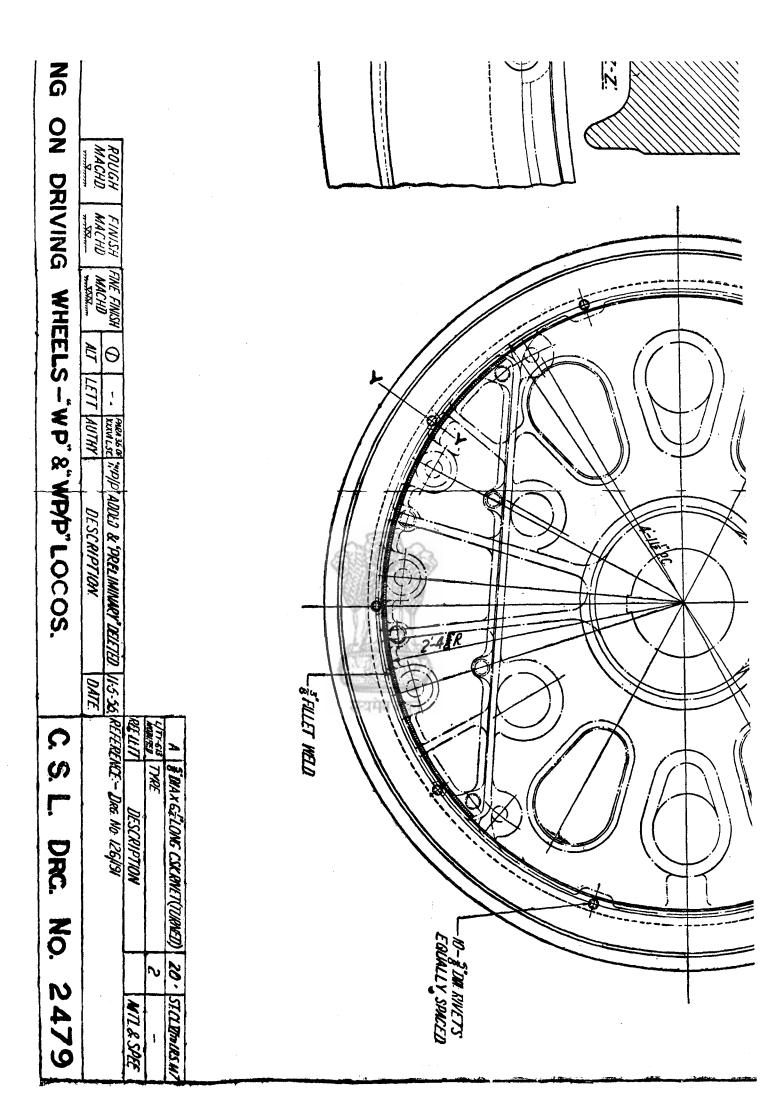


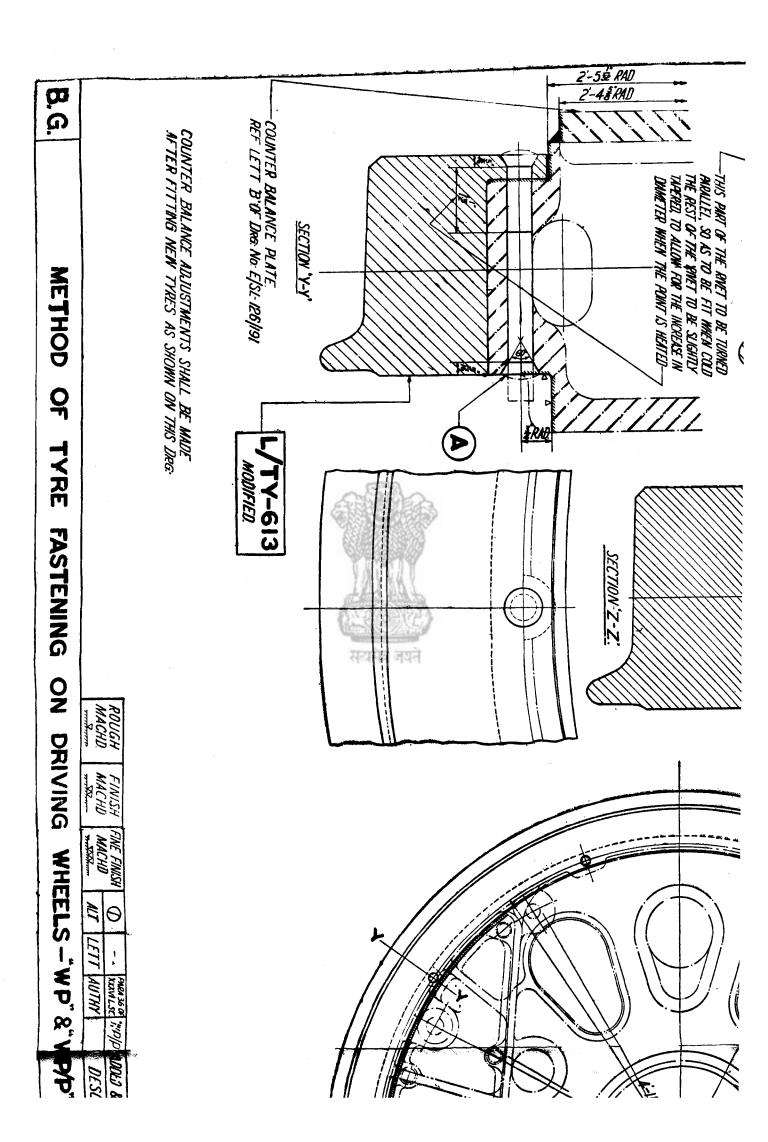


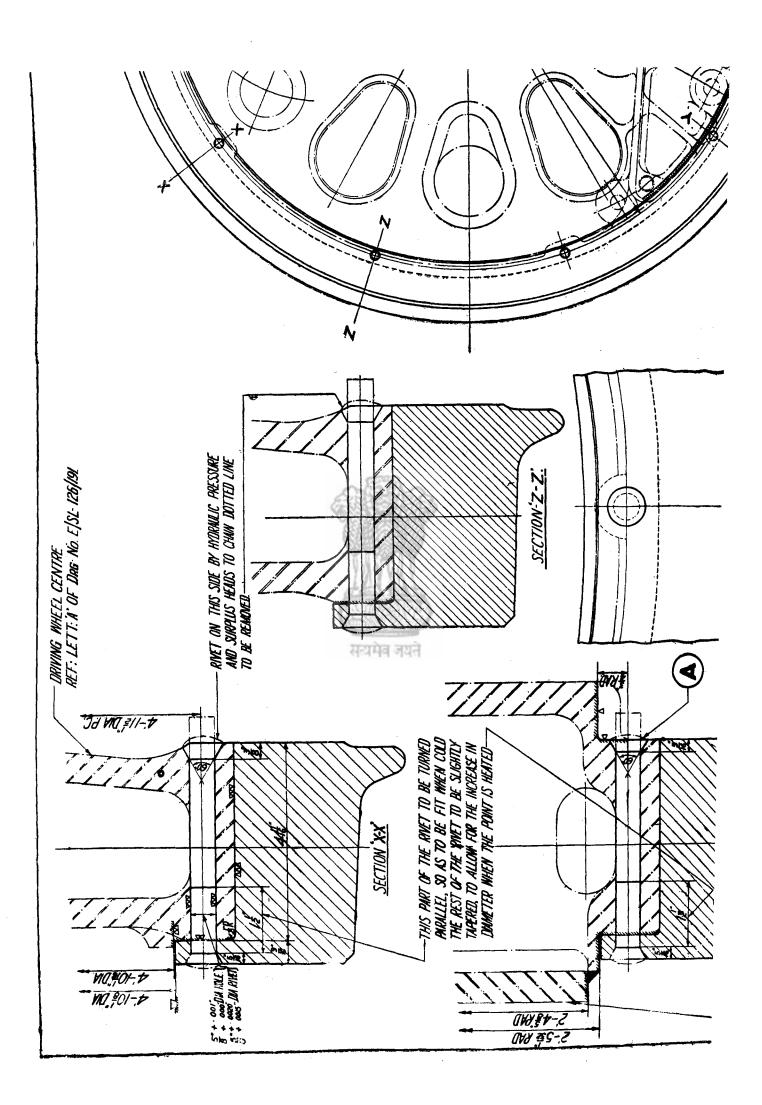


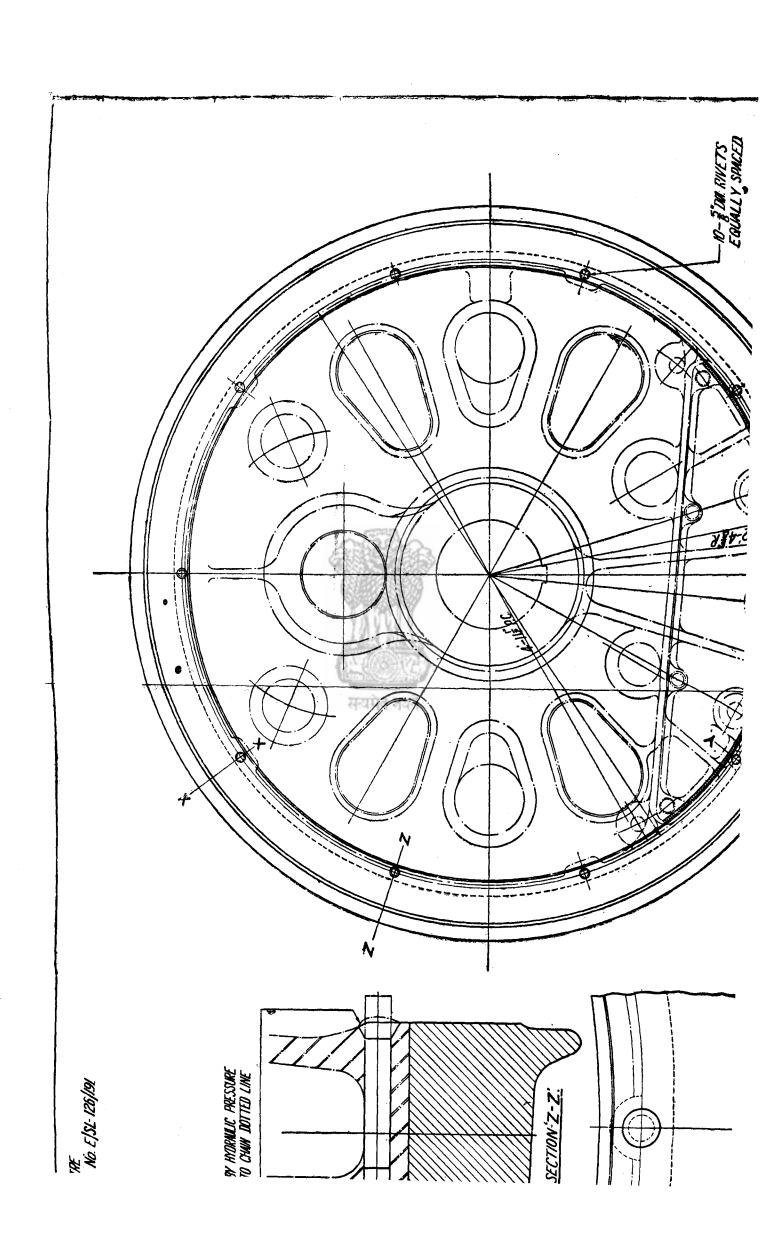


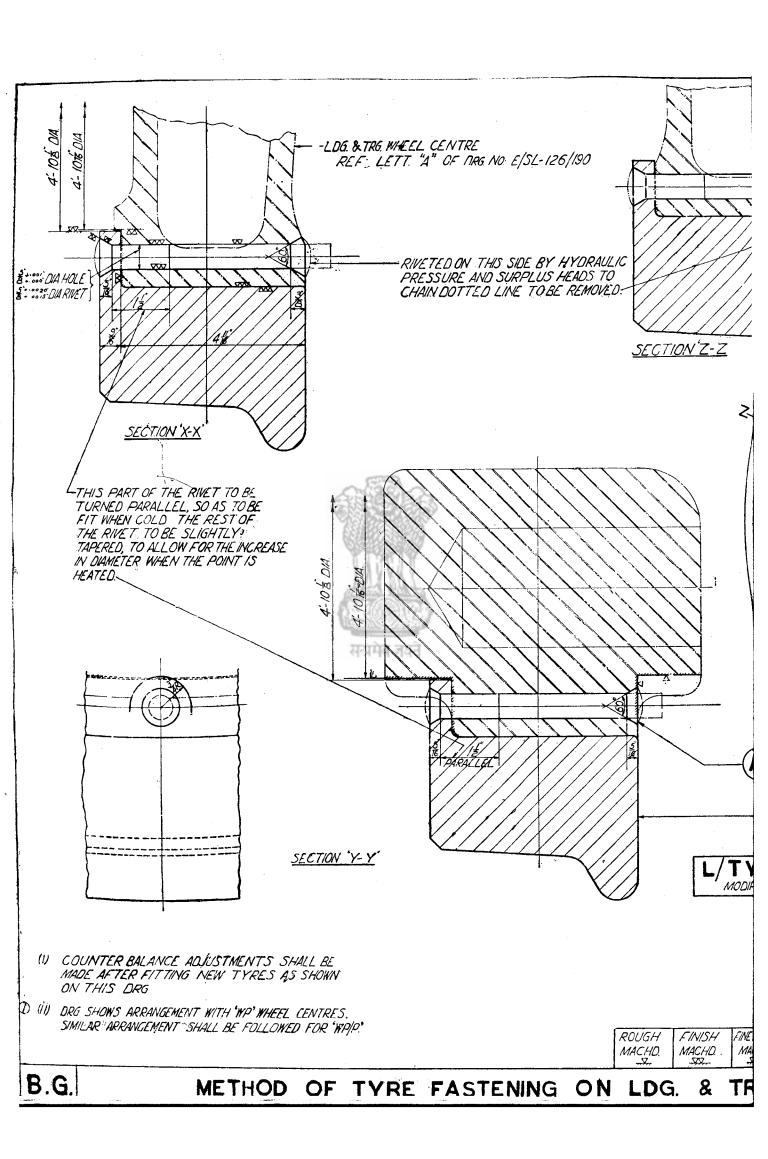


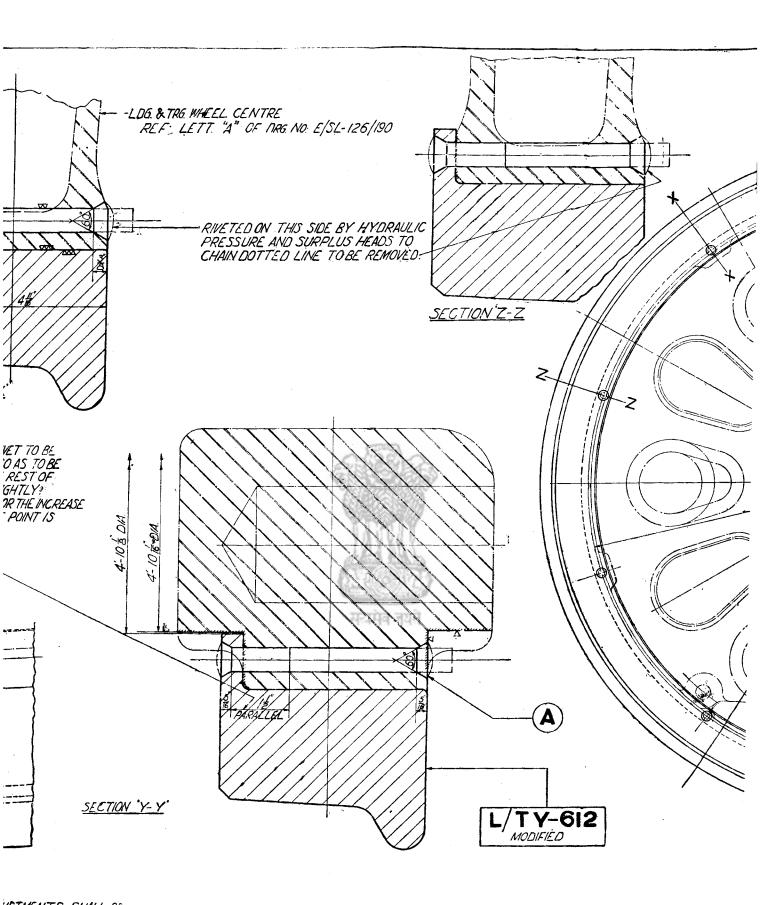










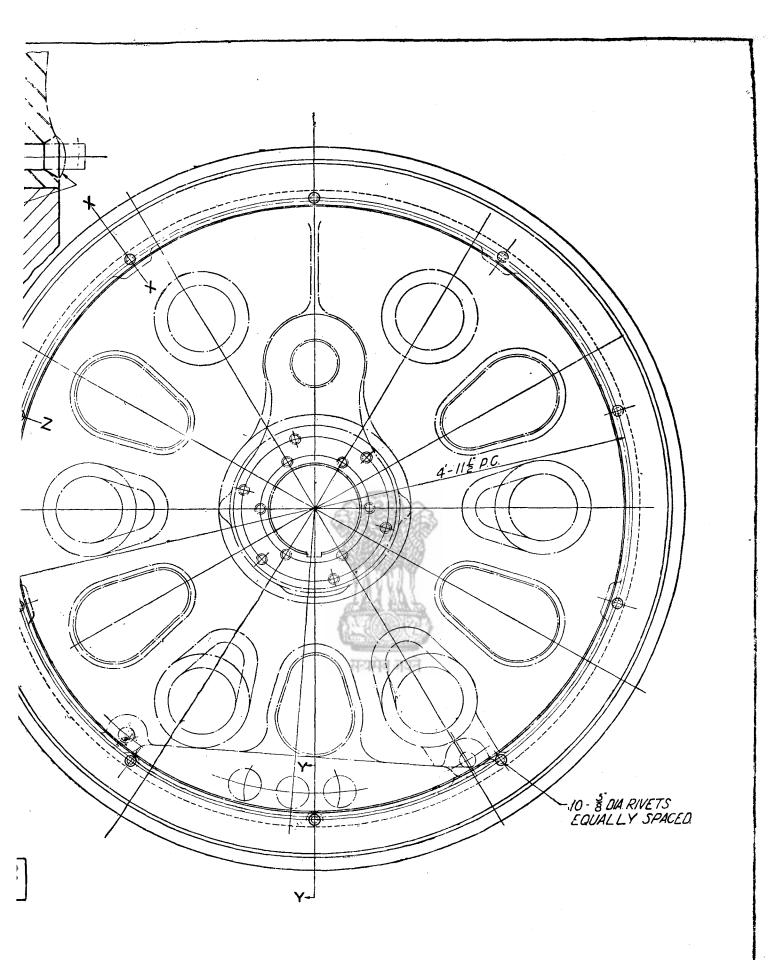


USTMENTS SHALL BE SW TYRES AS SHOWN

'(ITH 'WP' WHEEL CENTRES, 'L BE FOLLOWED FOR 'WP/P'

,	00050		FUE FUELS			DADA 36 OF	
	ROUGH		FINE FINISH.	· ( <i>y</i>		PARA 36 OF XXXVI LSC.	WPIP&I
	MACHO. 7-1	MACHD.	MACHD.	ALT.	LETT	AUTHY.	· Di

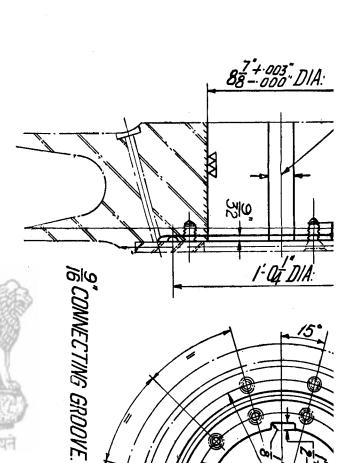
ETHOD OF TYRE FASTENING ON LDG. & TRG. WHEELS-WP'8.



								,
					А	EDM X 64 LONG CSK. RIVET (TURNED)	40	ST. CL. TITOLRS INT
					LITY-612 MODIFIED	TYRET	4	
					REF.LETI	DESCRIPTION	PERENG	MTL. & SPEC.
<b>(</b> )	_	PARA 36 OF XXXVI LSC.	WPIP & NOTE ADDED & PRELIMINARY DELETED.	11-6-56	REFE	RENCE: DRG NO E/SL 126/19	90	
147.	LETT	AUTHY:	DESCRIPTION	DATE		·		
								Į.

VHEELS-WP & WP/P LOCOS. C.S.L. DRG. No. 2480

IAL HOLES TAPPED WHEEL CENTRES S. L. Drg. No. 2214



LDG: & TRG: WHEEL CENTRES MODIFIED AS SHOWN.

CENTRES AS PER C.S.L.

TAPPED \$ B.S.N. IN WHEEL

-2-ADDITIONAL HOLES

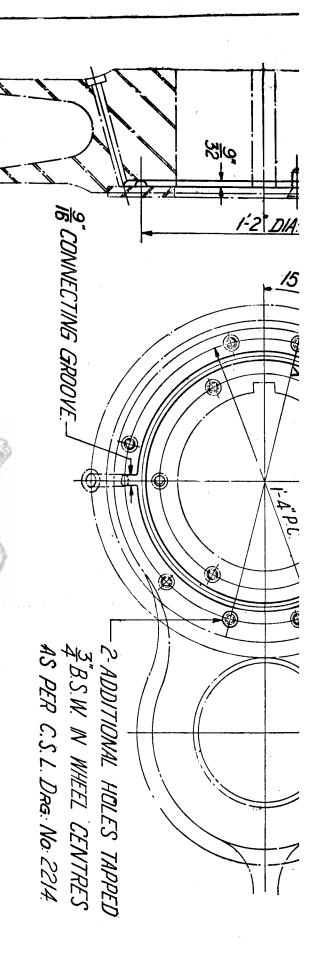
DRG: No. 2214

RG NO CZ14. CZ8	1, <i>t.</i> 3.L.D.	2289 & 2525.		DATE.	
MTL. & SPEC.	PER.ENG	DESCRIPTION	REF.LETT.		
COPPER TO I.R.S. N-17.	84	3 BS. W. SCREW	A		

O SUIT 83 DIA JOURNAL-WP'LOCOS C. S. LUBRICATION AND L. DRG: No: 25/2

DESCRIPTION

SUPERSEDES CS.L. Des No 2229



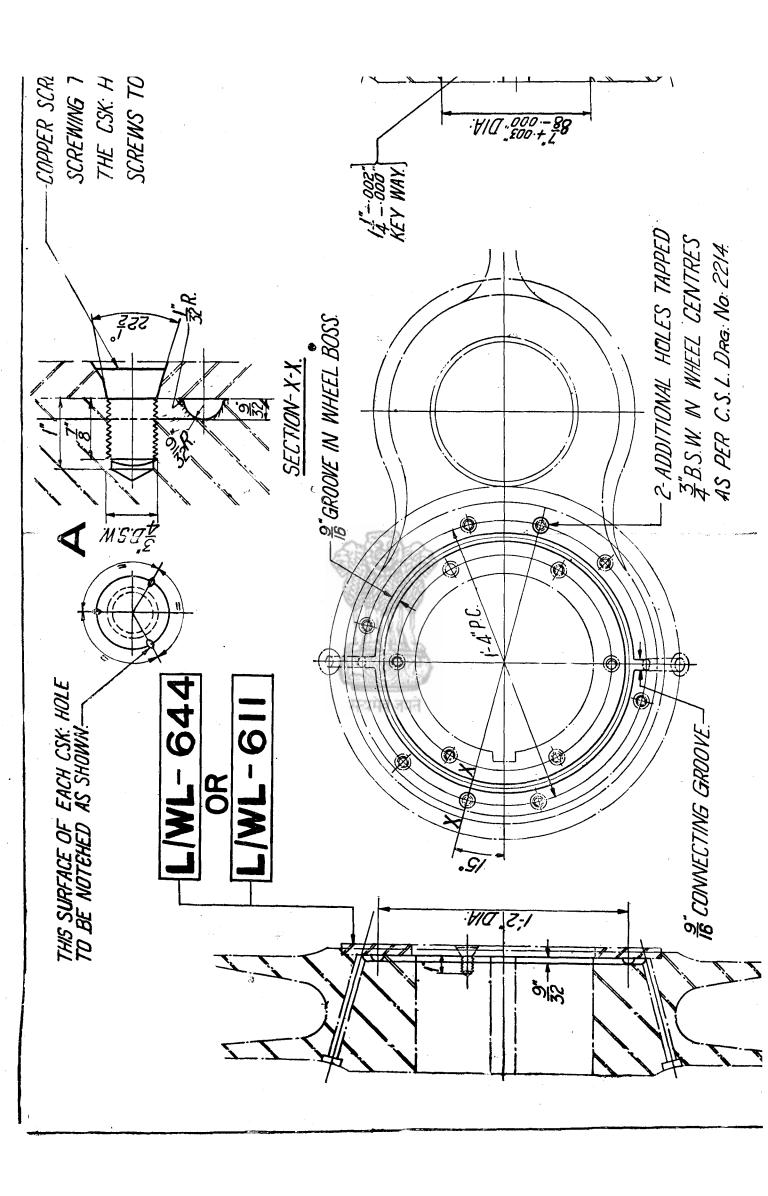
## DRIVING WHEEL CENTRE MODIFIED AS SHOWN.

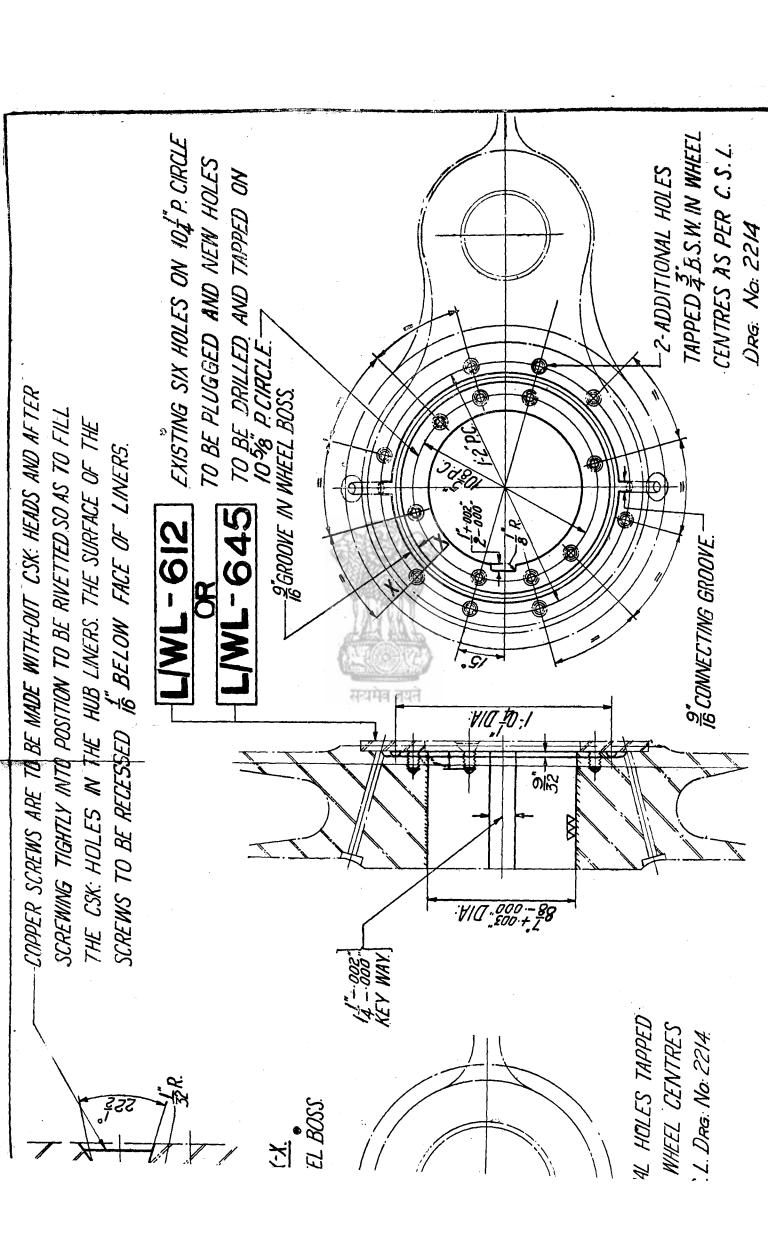
I CAST IRON LINERS TO IR PART DRGS: L/WL-611 & L/WL-612, ARE MANUFACTURE ONLY I.R. PART DRG: Nos. L/ML-644 & L/WL-645 FOR INDIGENOUS PERMISSIBLE ALTERNATIVES TO MANGANESE STEEL LINERS TO

2 LUBRICATION ARRANGEMENT SHOWN ON THIS DRG: IS

APPLICABLE TO 'WP' LDG: & TRG: WHEELS WITH

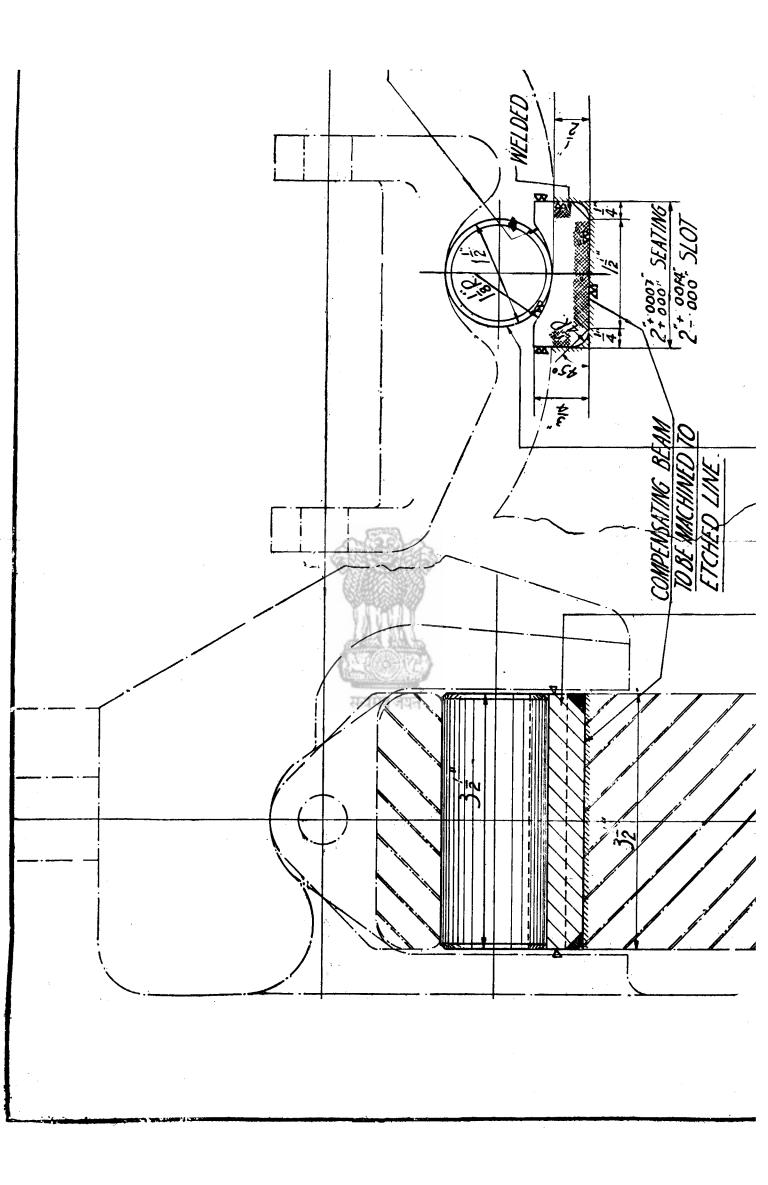
B. G. MODIFICATION TO LDG: & TRG: WHEEL HUBS TO SUIT 8 DIA JOURNAL-8"DIA JOURNAL ALSO. REVISED ARRANGEMENT OF WHEEL LETT AUTHY HUB LUBRICATION AND DESCRIPTION

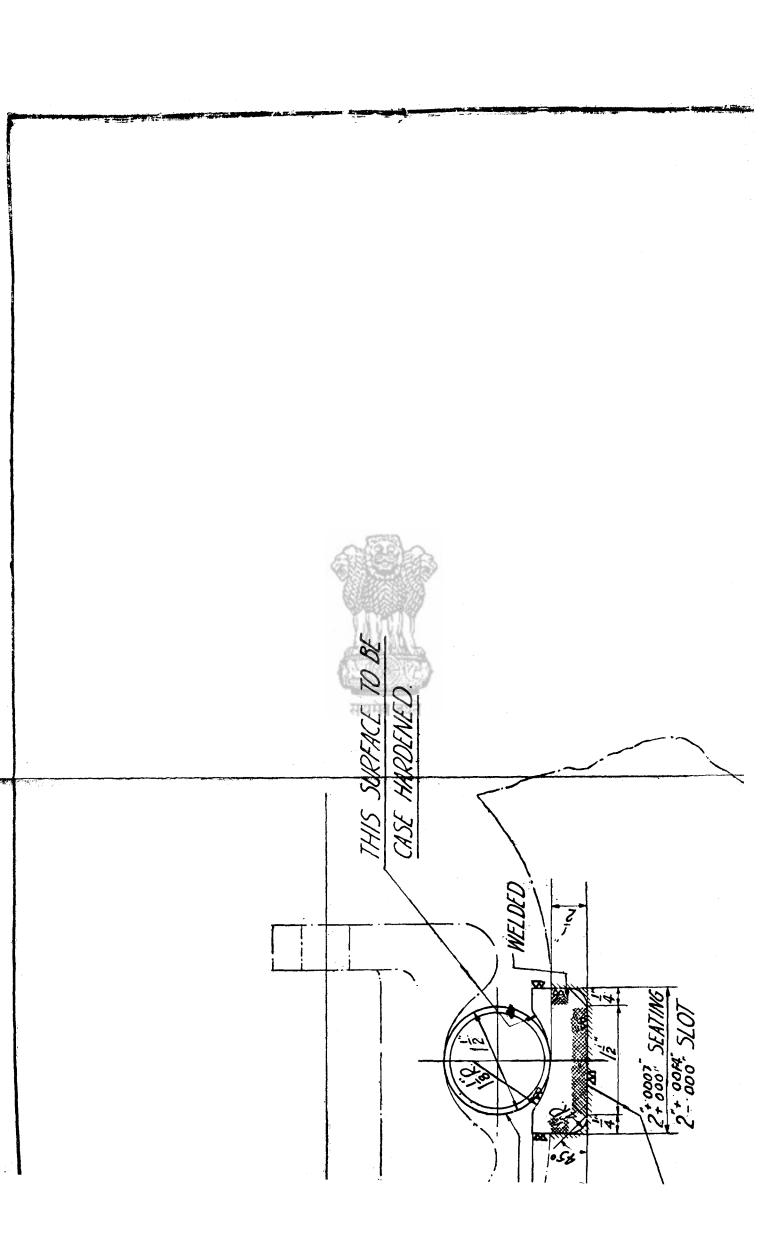


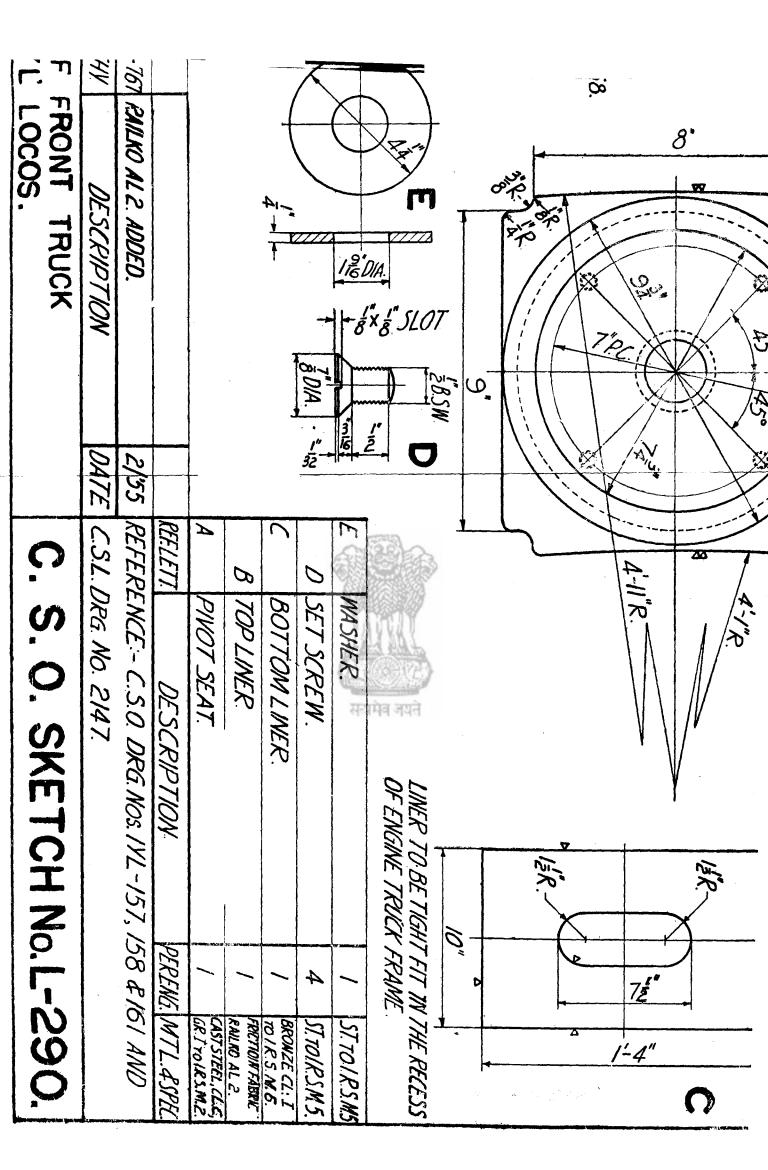


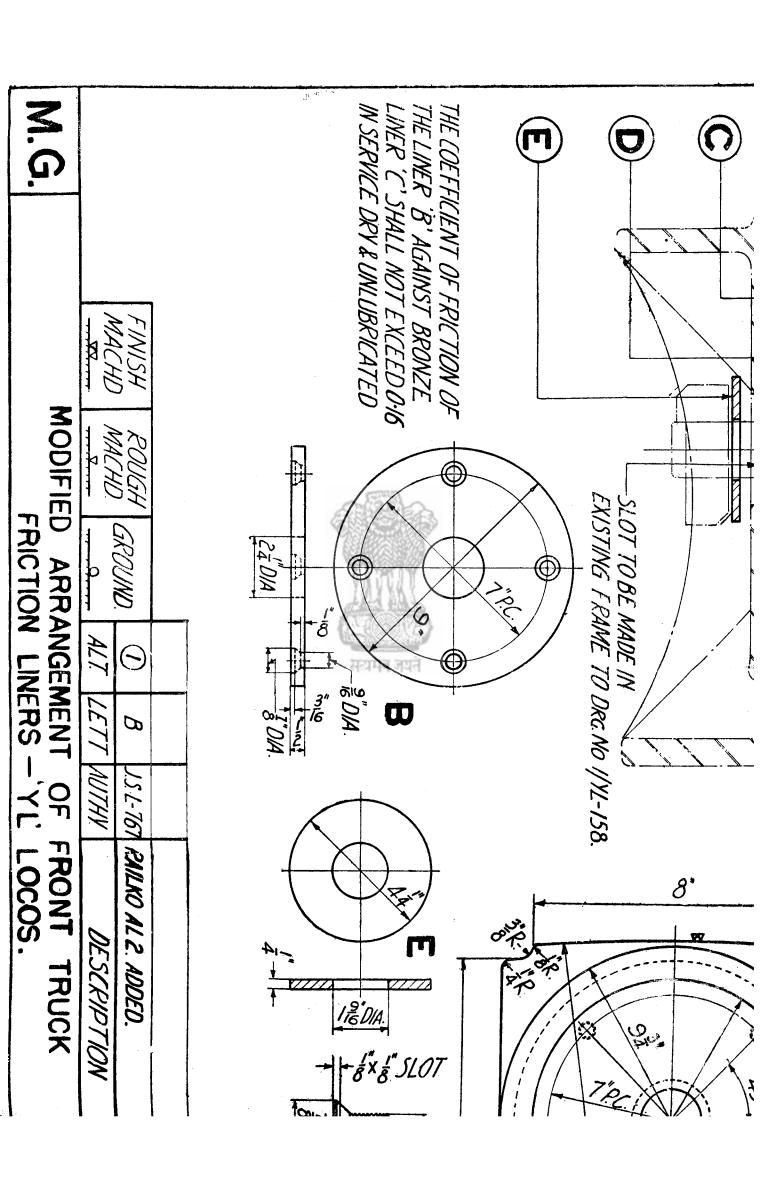
M PINTLE FOR WP' LOC	TH DESCRIPTION					2+000; SEATING 2+000; SEATING 2+000; SEATING
LOCOS. C. S. O. SKET	047E KEFEKENCE :- CES OKO. NO. E/SZ. 126/145 & 208.	NEFLETT DESCRIPTION	ROLLE	B SEATING	सयमेव जयन	
SKETCH Nº L-90	152.126/145 & 208.	PER SMG MTL & SPEC.	4 STGLETO LRS.M.F.	A SICLIDIES.MA		

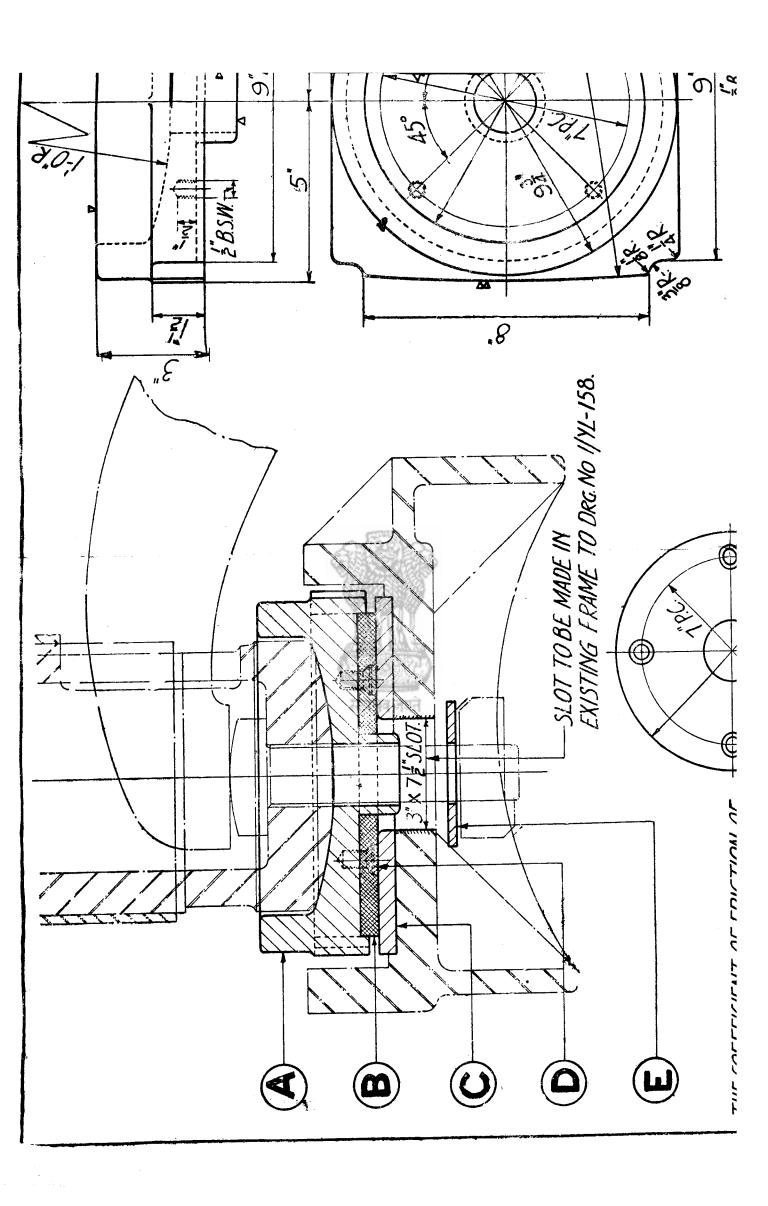
MODIFIED COUPLED COMPENSATING BEAM PINTLE FOR WI W ETCHEO LINE AUTH 2"+ 000 5LOT 2+0007 SEATING OESCRIPTION

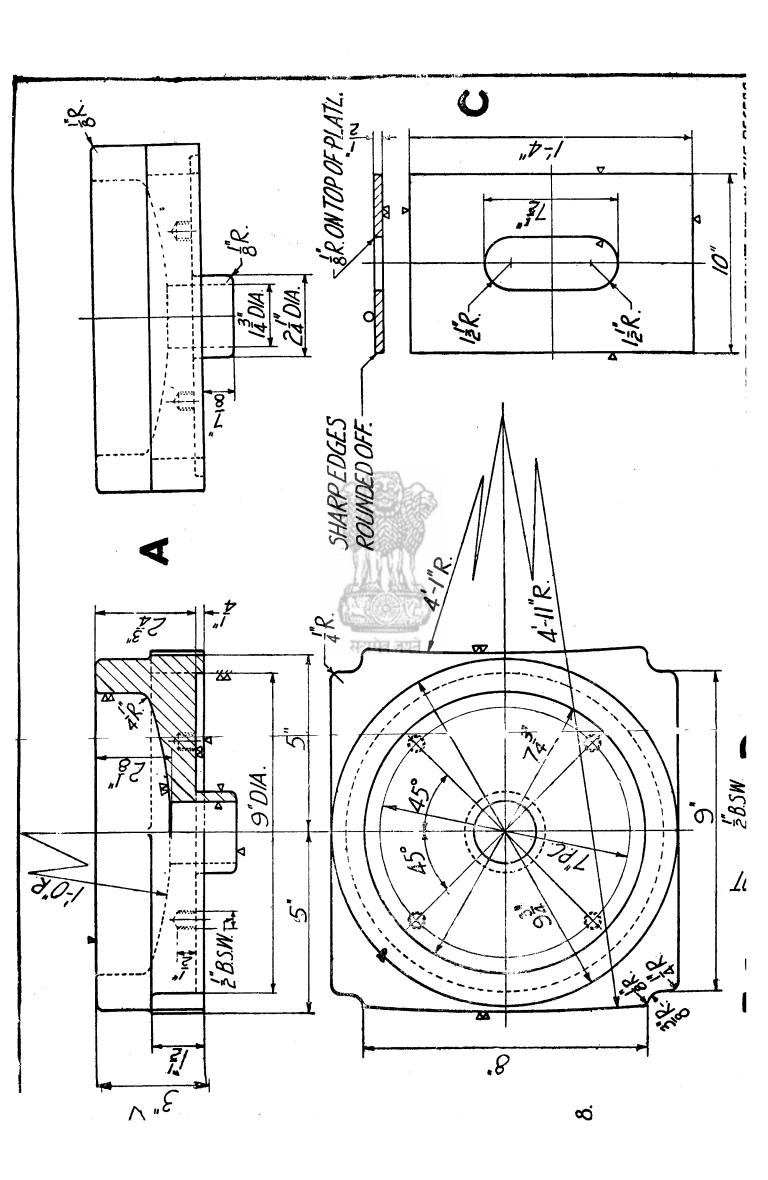


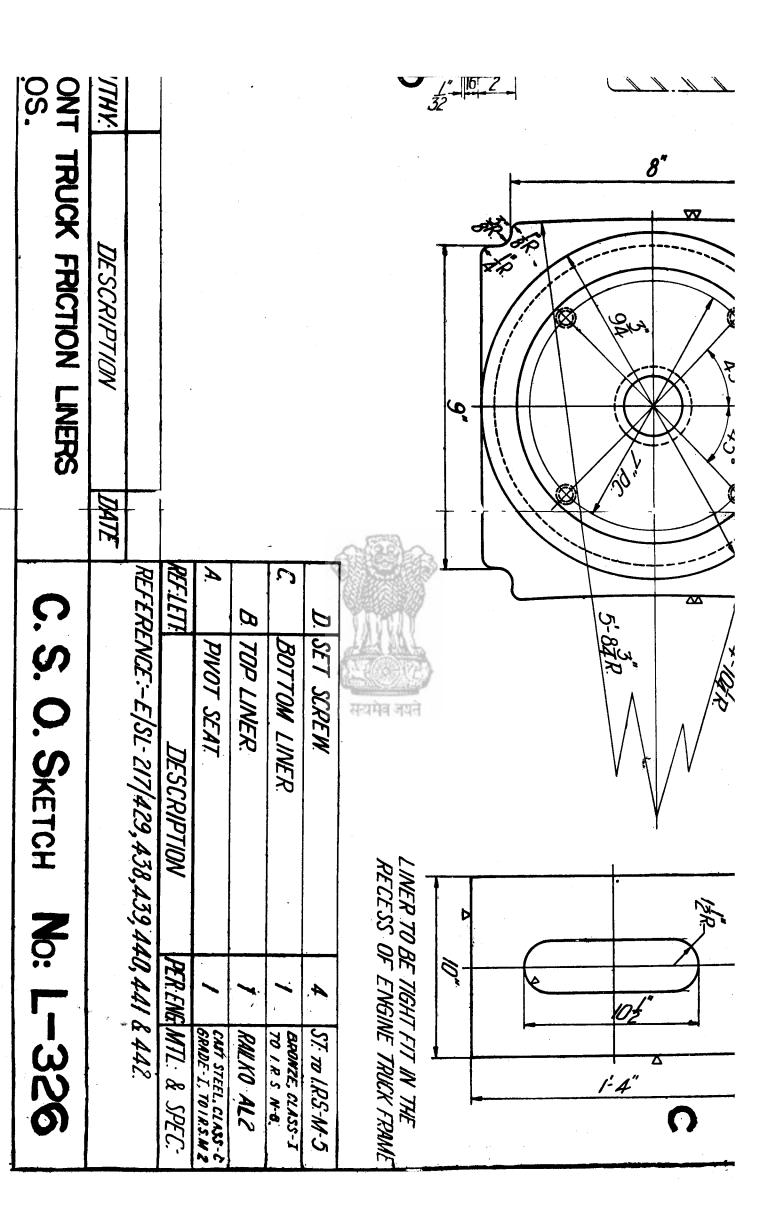


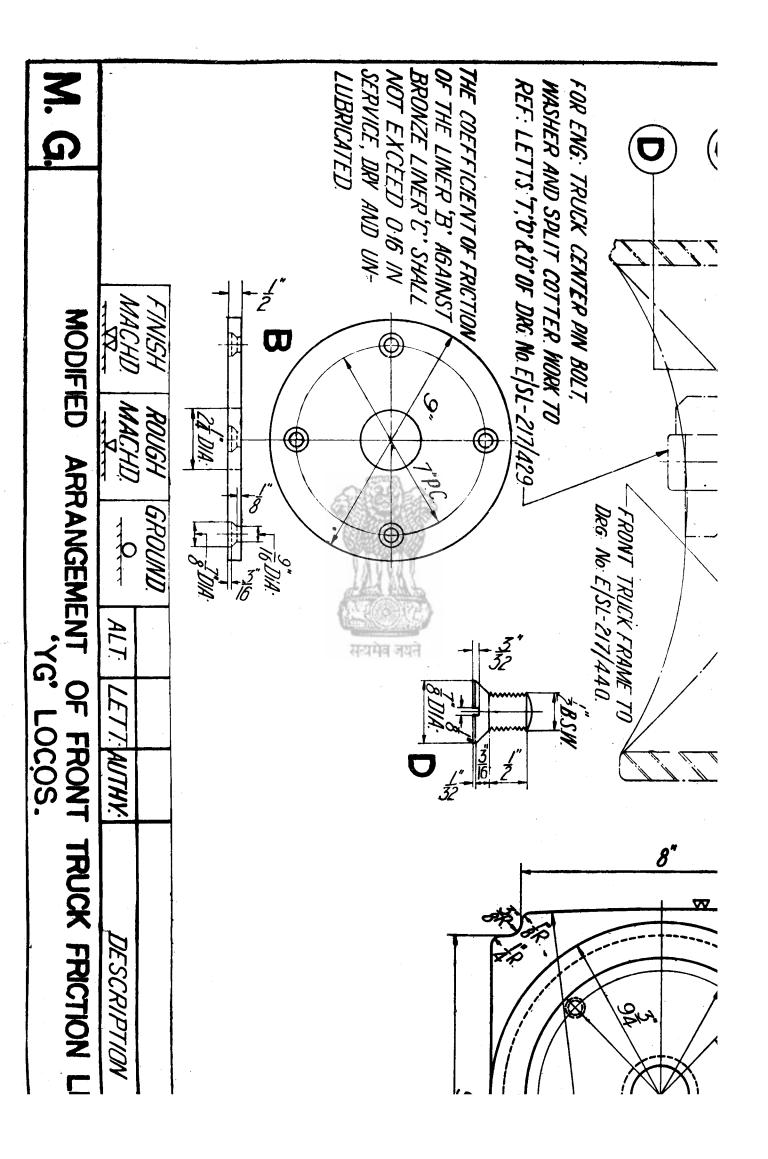


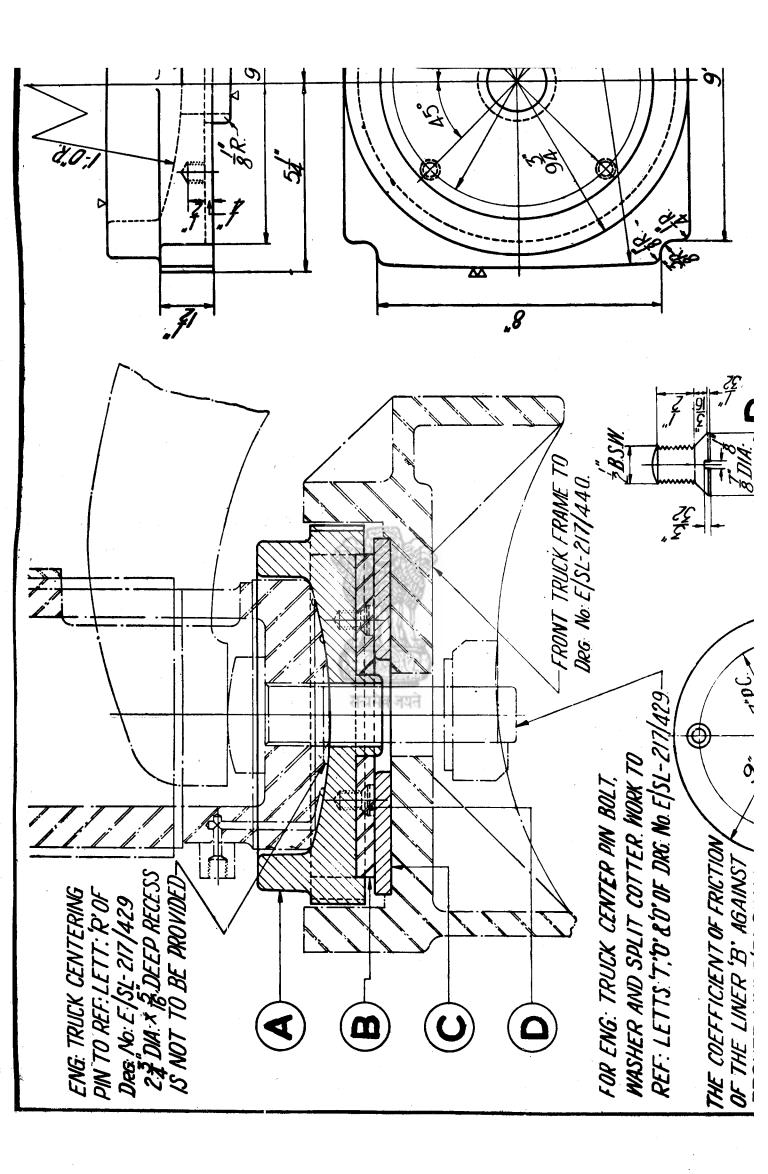


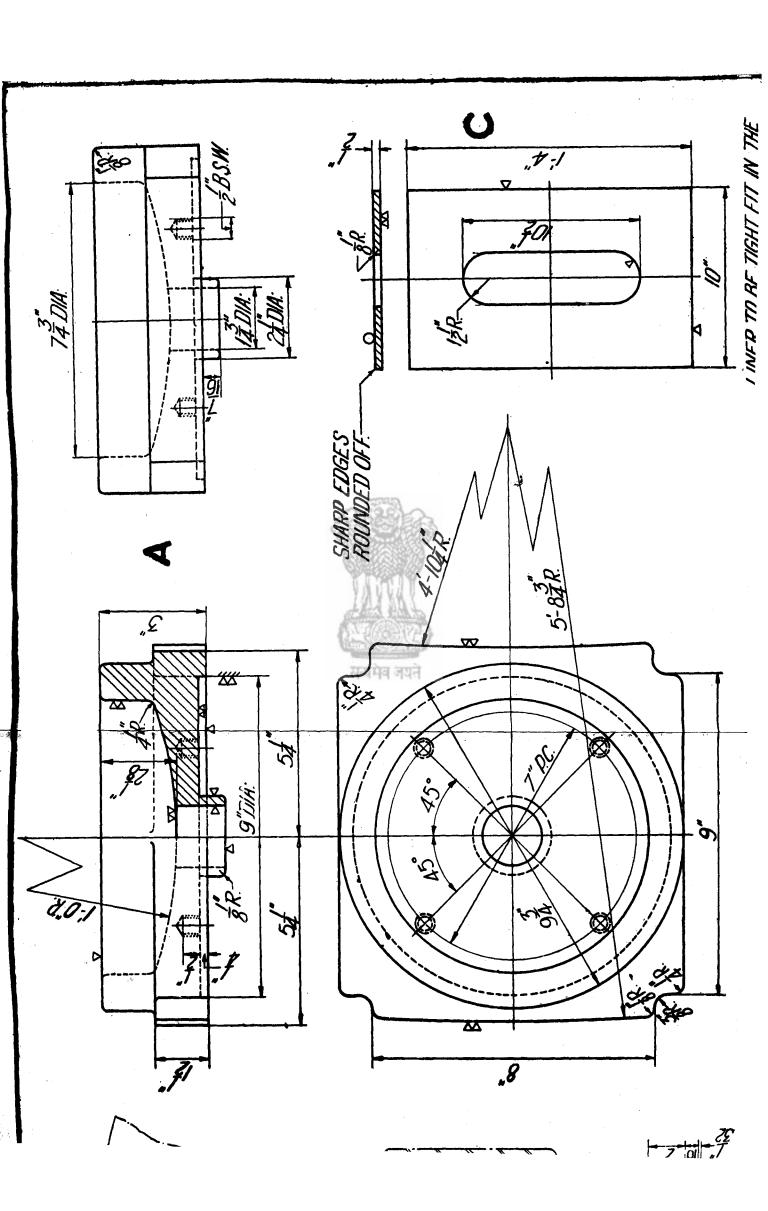


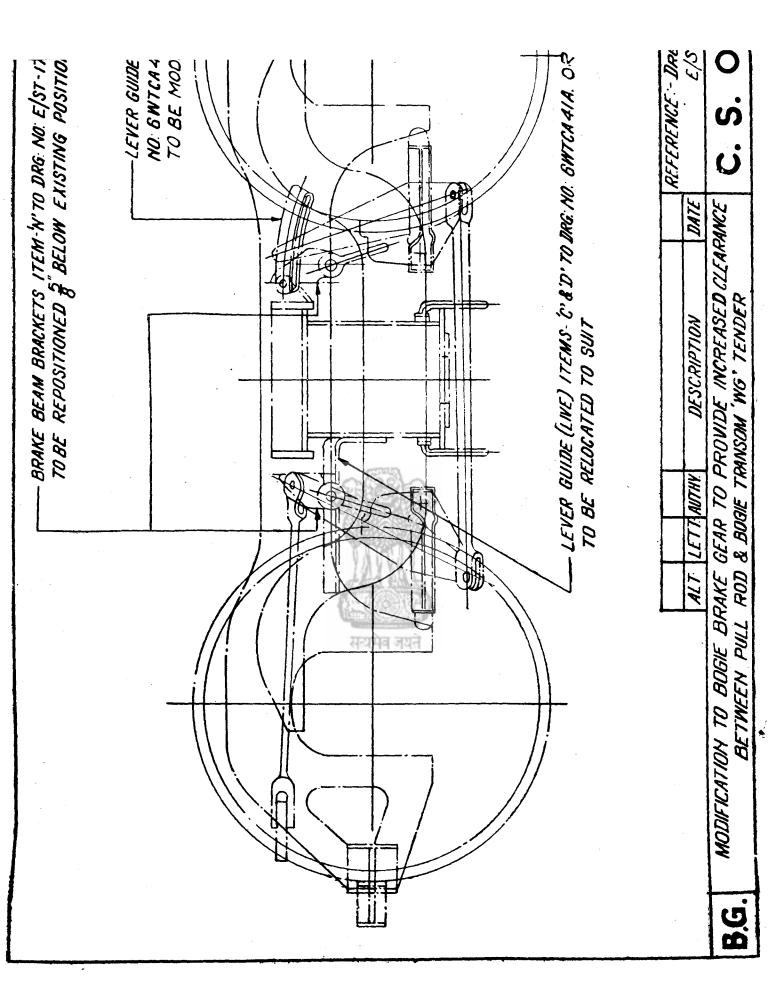


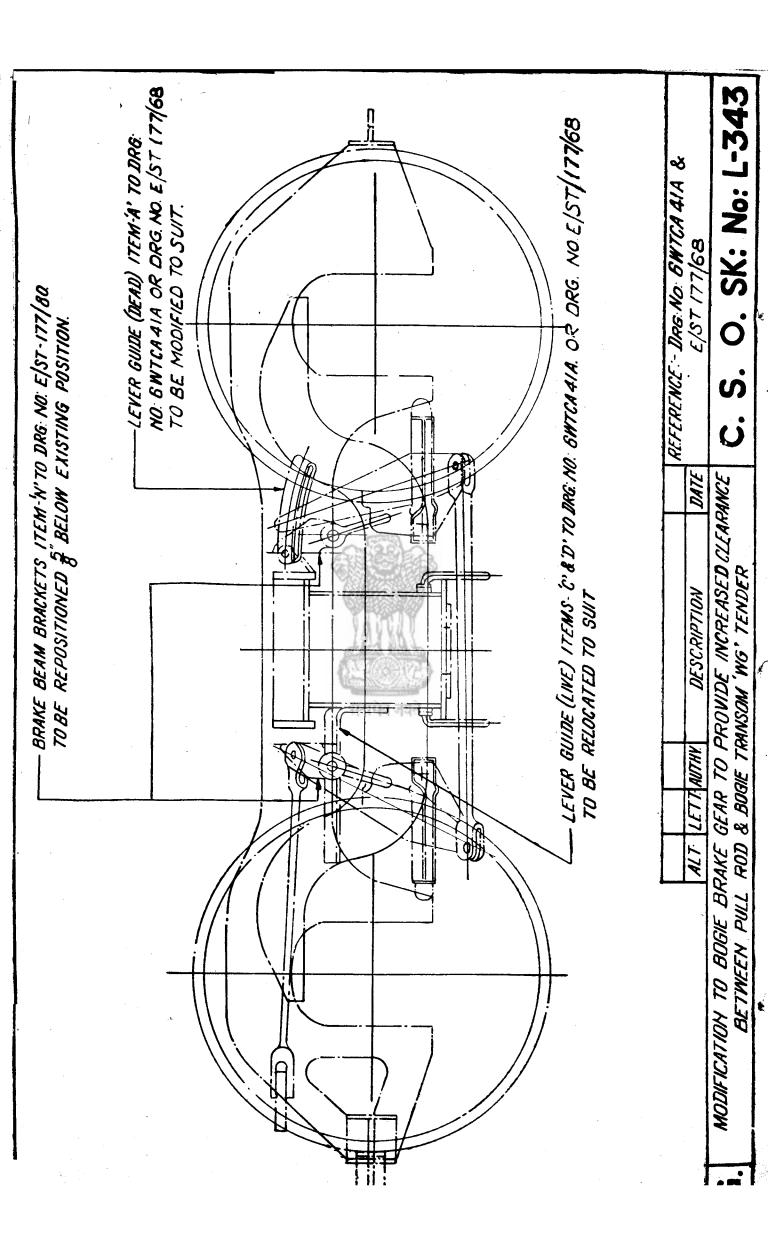


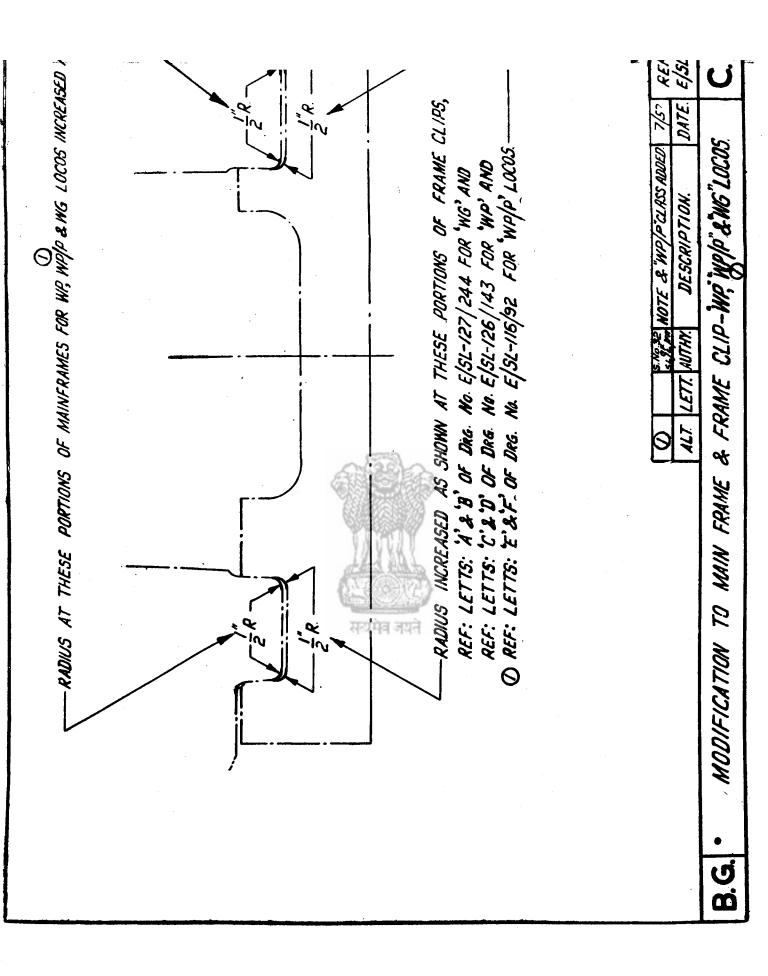


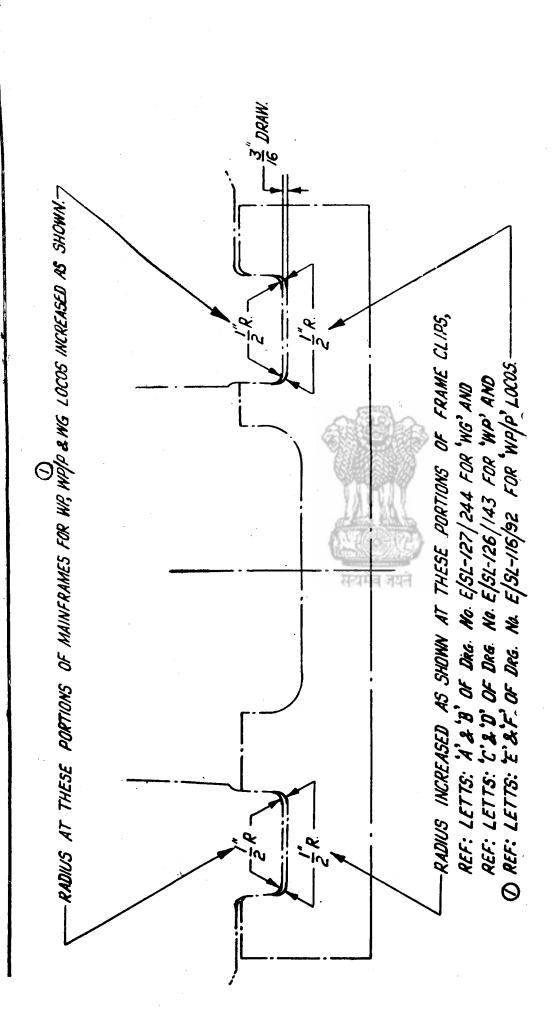






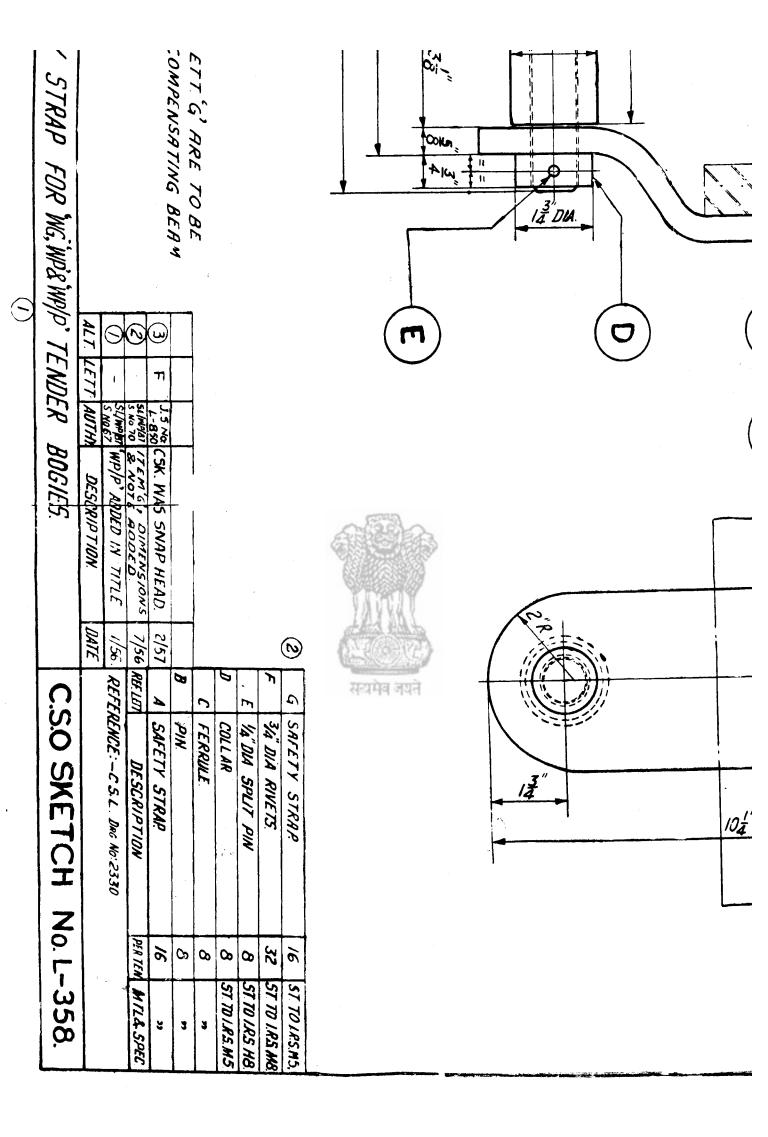






9		5.40.X	NOTE & WP/PCLASS ADDED	7/57	"HE NOTE & WP/P'CLASS ADDED 7/5" REFERENCE:- DRG. NOS E/S1-127/36, 1378 244	
777	1137	AUTHY	DESCRIPTION.	DATE.	DATE. E/SL-126/139 & 143. E/SL-116/92 493	
			4 : 7		9	_

C.S.O. SKETCH No.L.354 MODIFICATION TO MAIN FRAME & FRAME CLIP-WP. WIPP ANG LOCUS



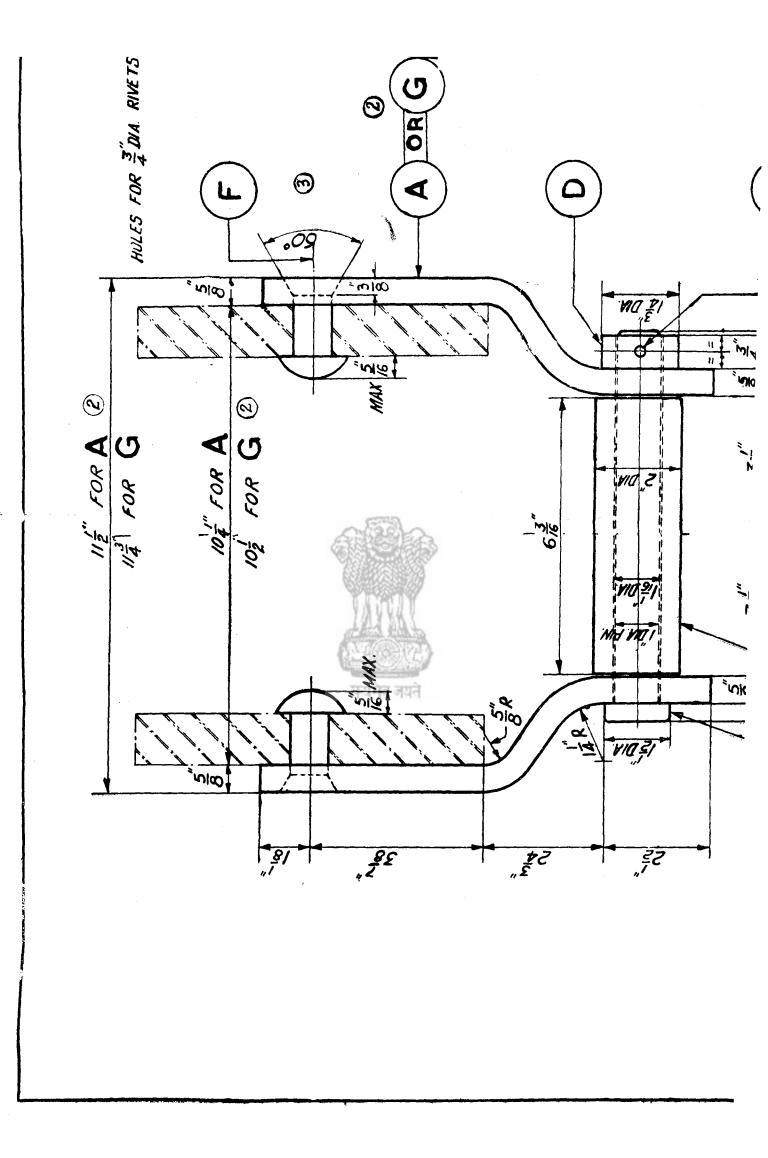
B.G.

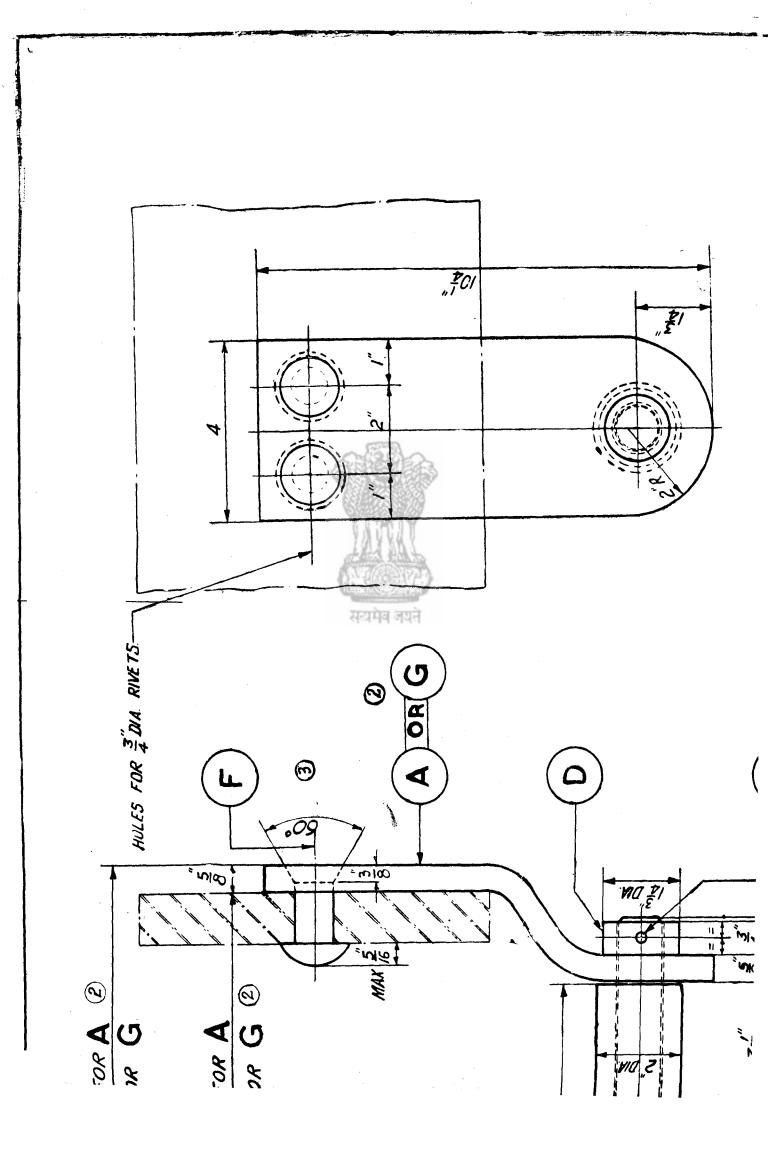
REVISED DESIGN OF BEARING SPRING SAFETY STRAP FOR WE, WPS WP/P' TENDER ALT LETT AUT

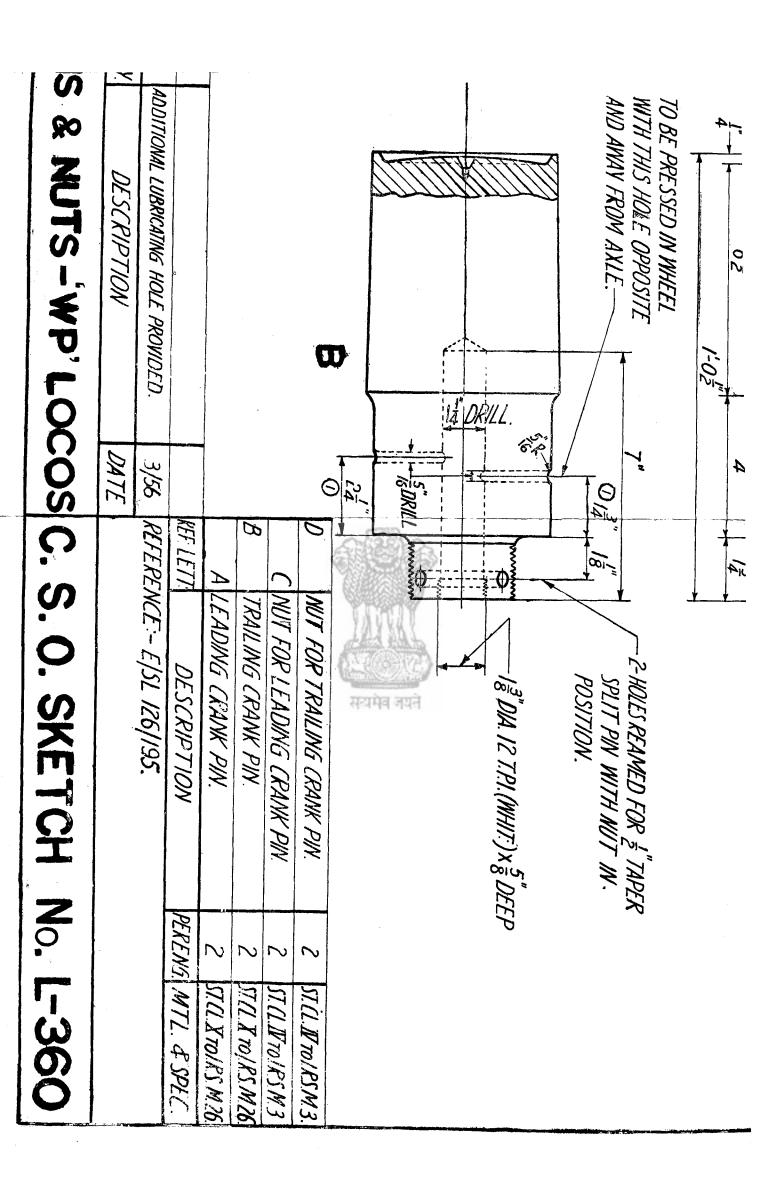
**O** Œ NOTE:-SAFETY STRAPS TO REF. LETT G' ARE TO BE FITTED TO WP/PS.WITH COMPENSATING BEAM TO DRG.NO.E/ST-116/55. MO, 883" 72/" COK 14 DU.

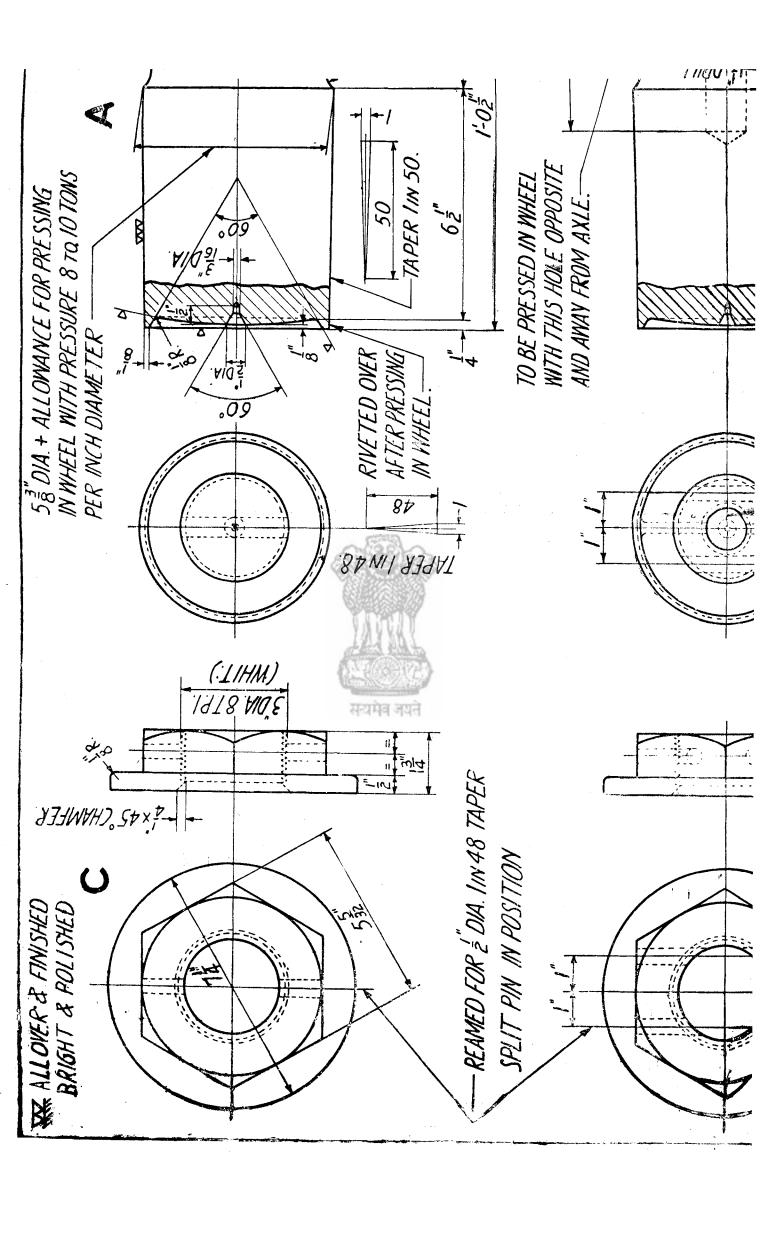
ار ماري ماري

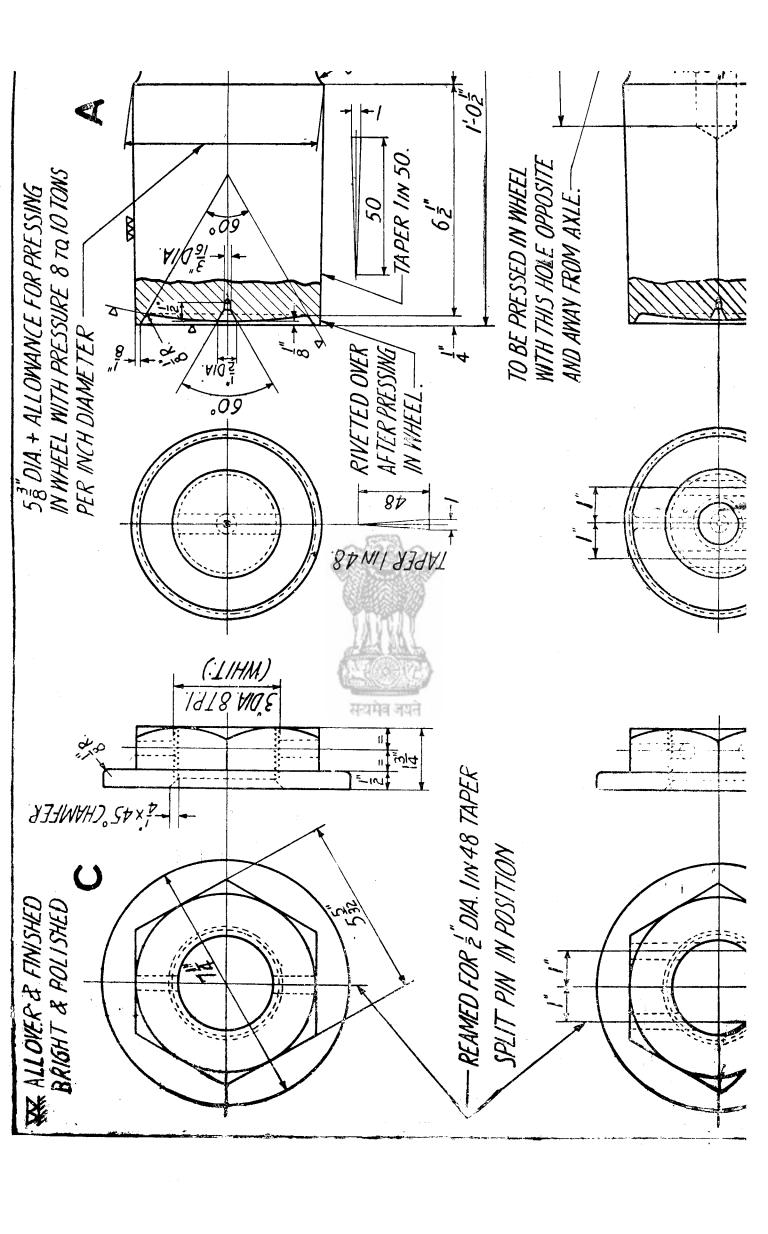
213°

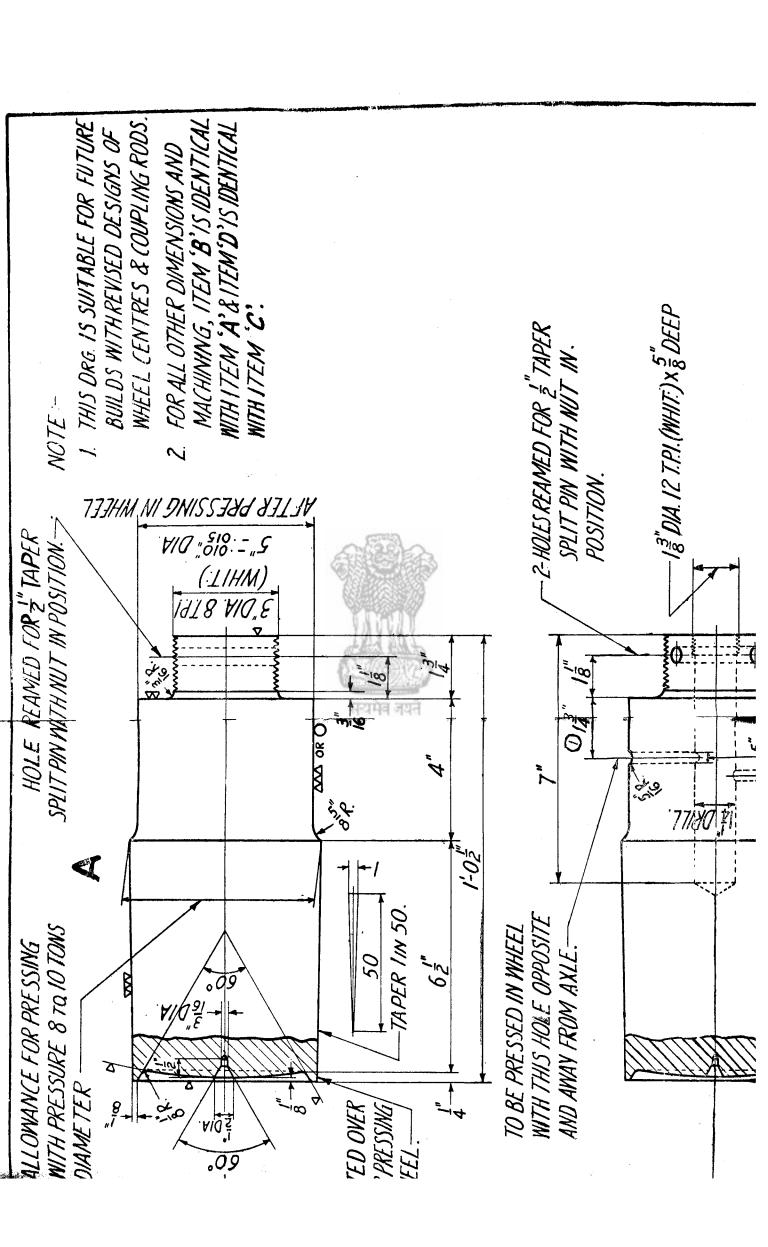


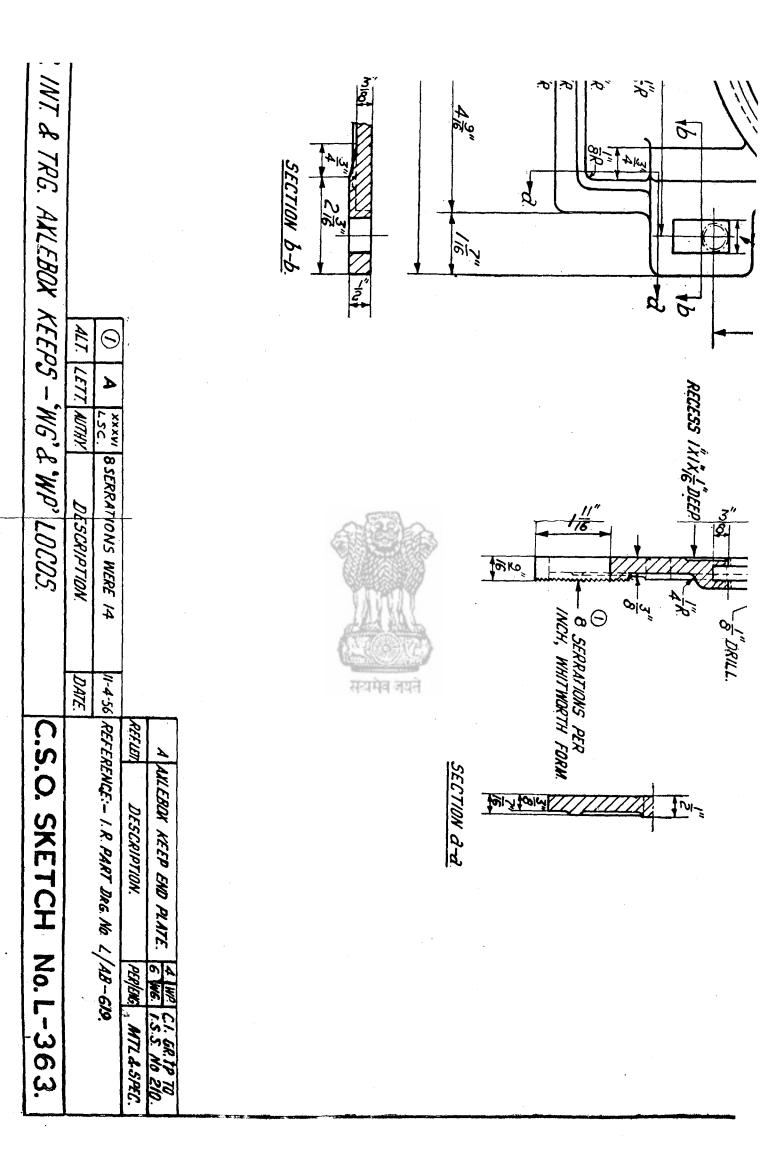








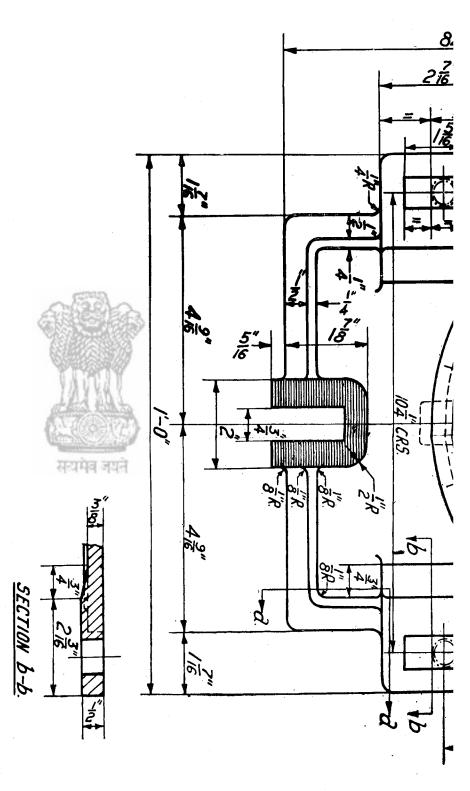




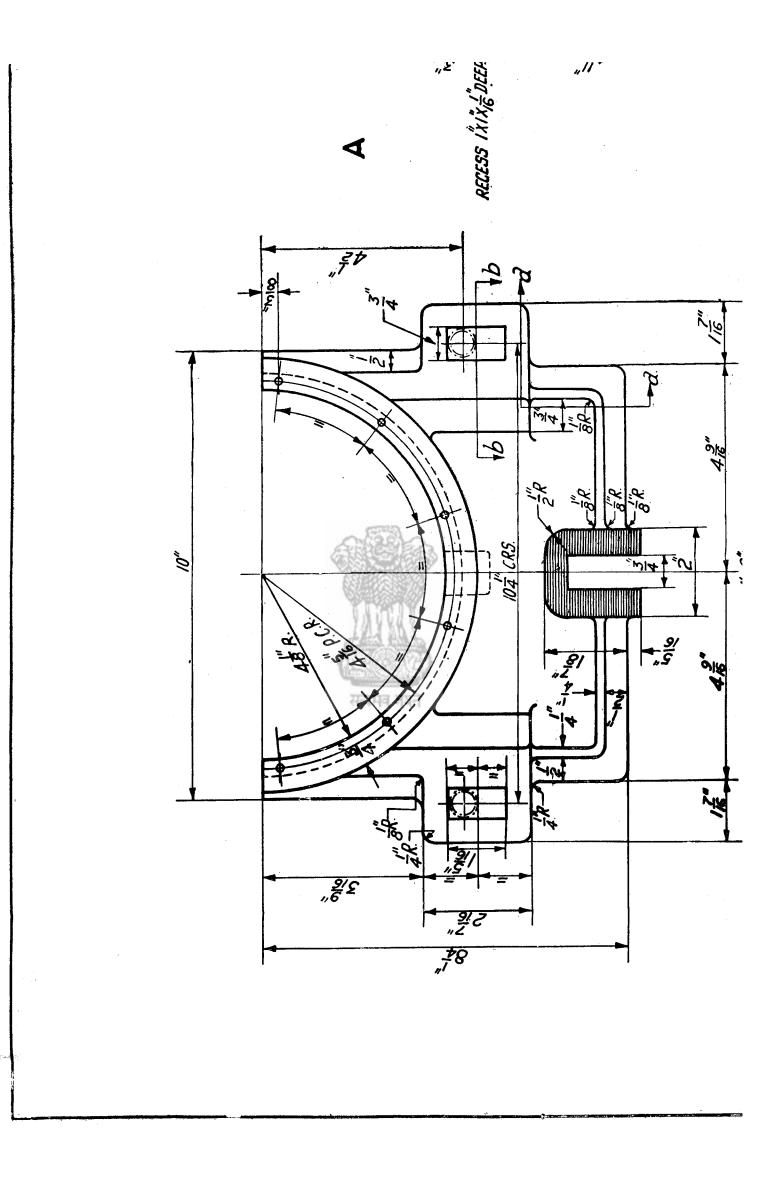
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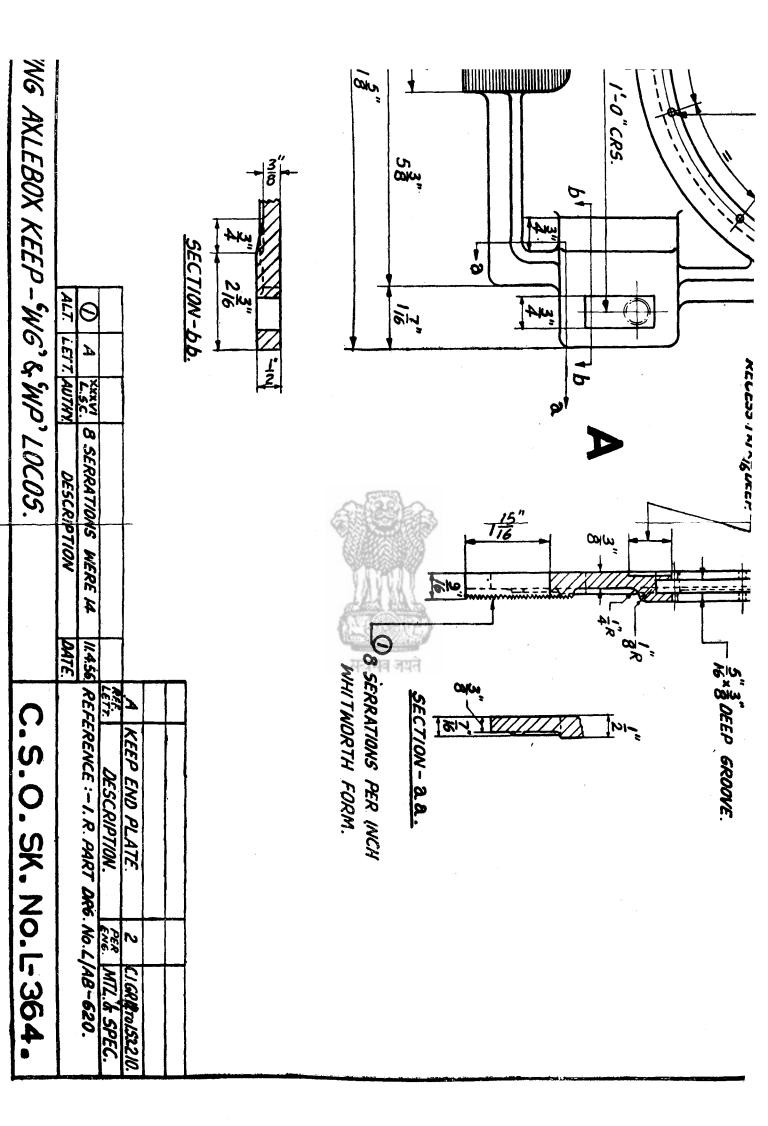
A

75C. 851

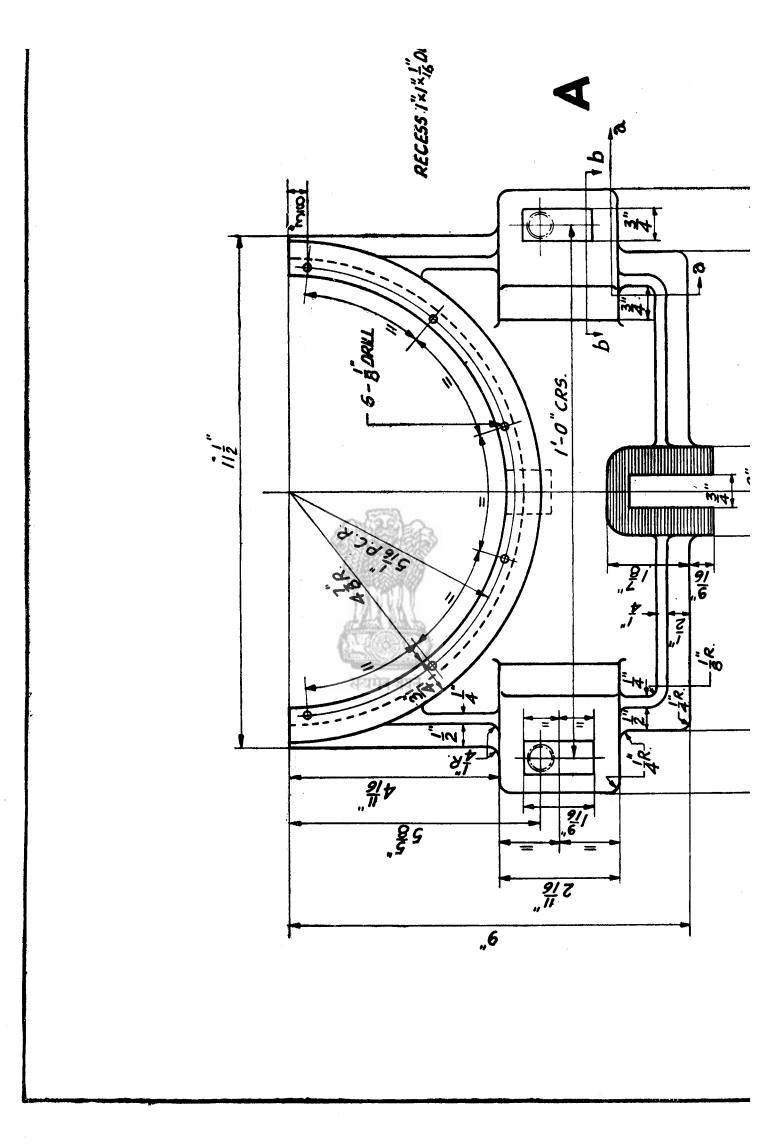


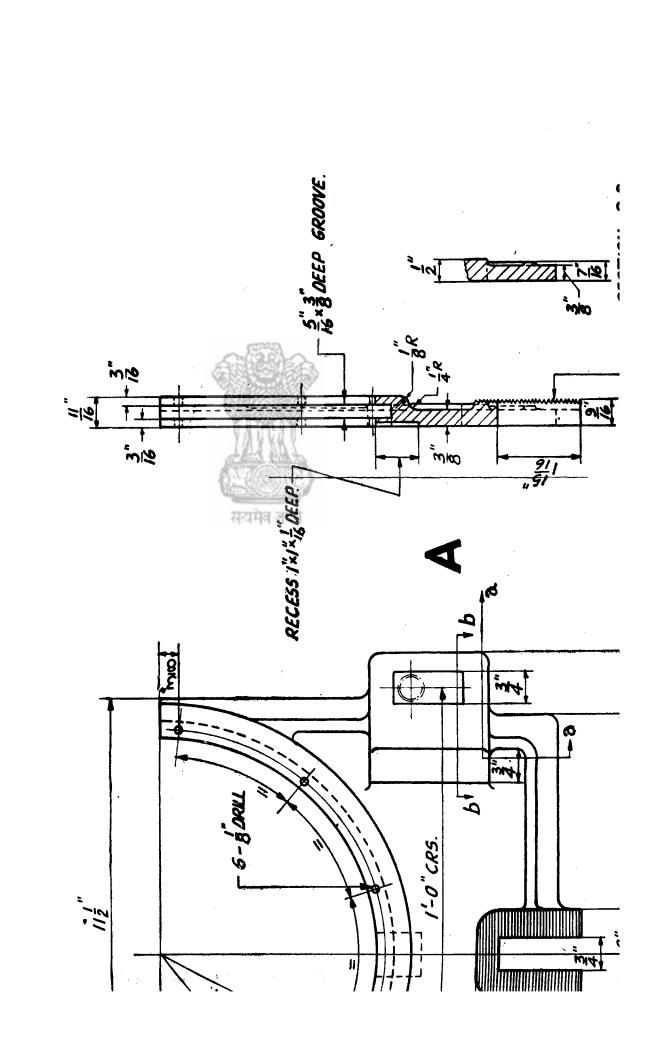
RECESS IXIX

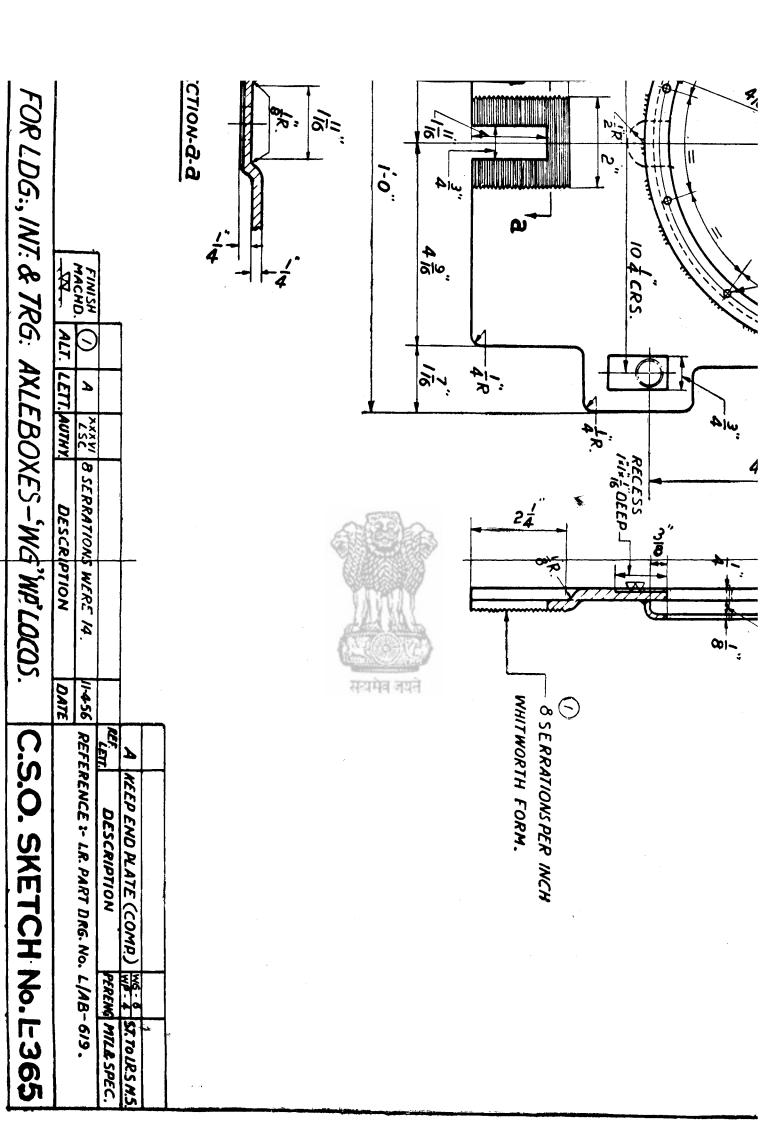


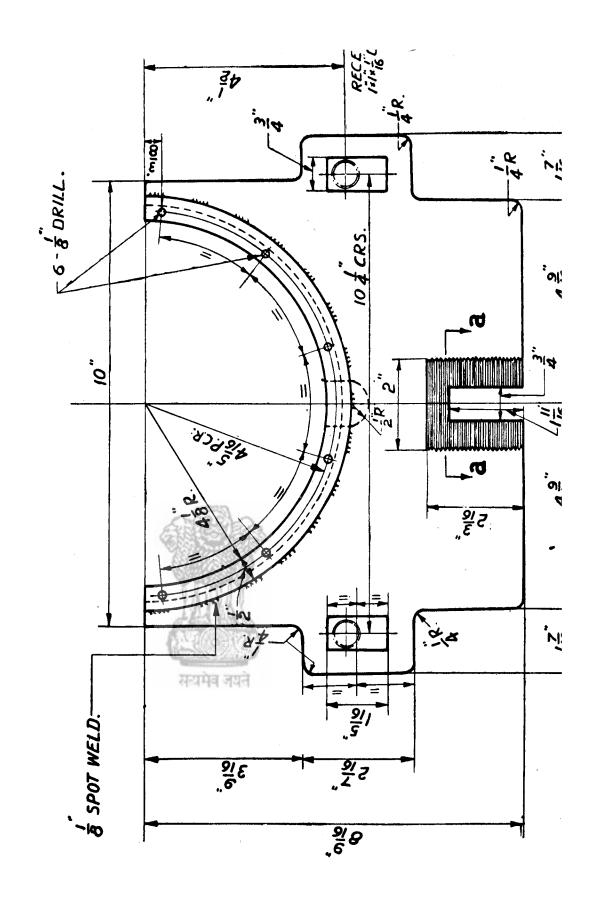


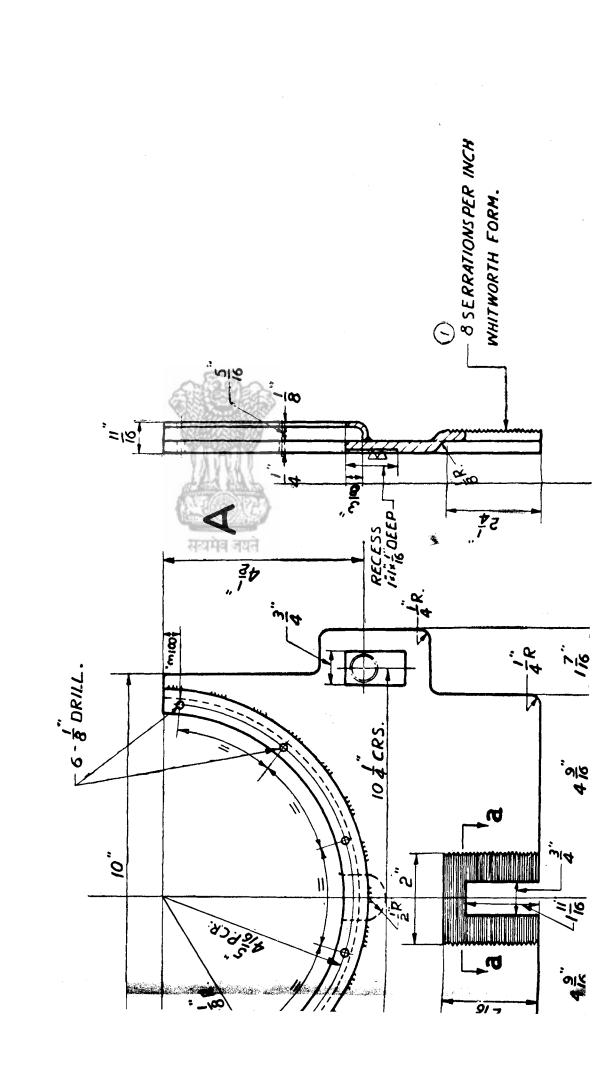
B 9" MODIFIED KEEP END PLATE FOR DRIVING AXLEBOX KEEP-"WG" & WP" L 2 16" 176 I'R. COLOR. (M) (M) <u>9</u>' 1-185" 1'-0" CRS. OKY. SECTION-66. 6 1617 LETT AUTHY

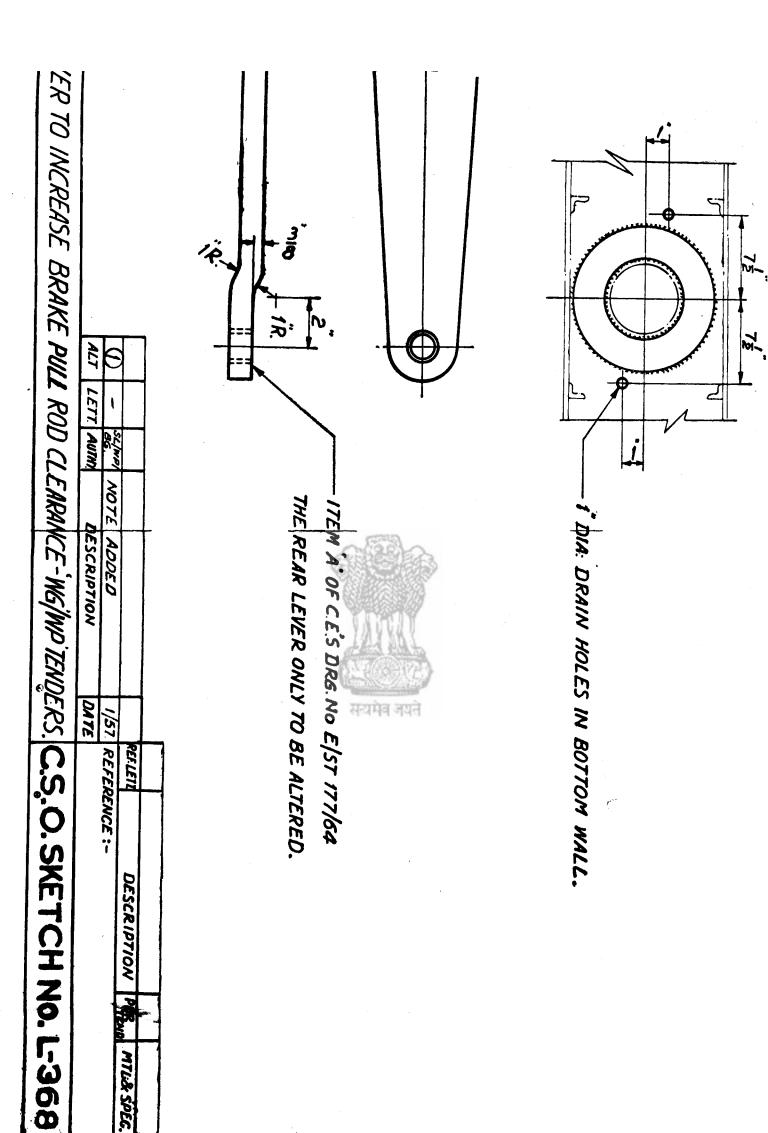


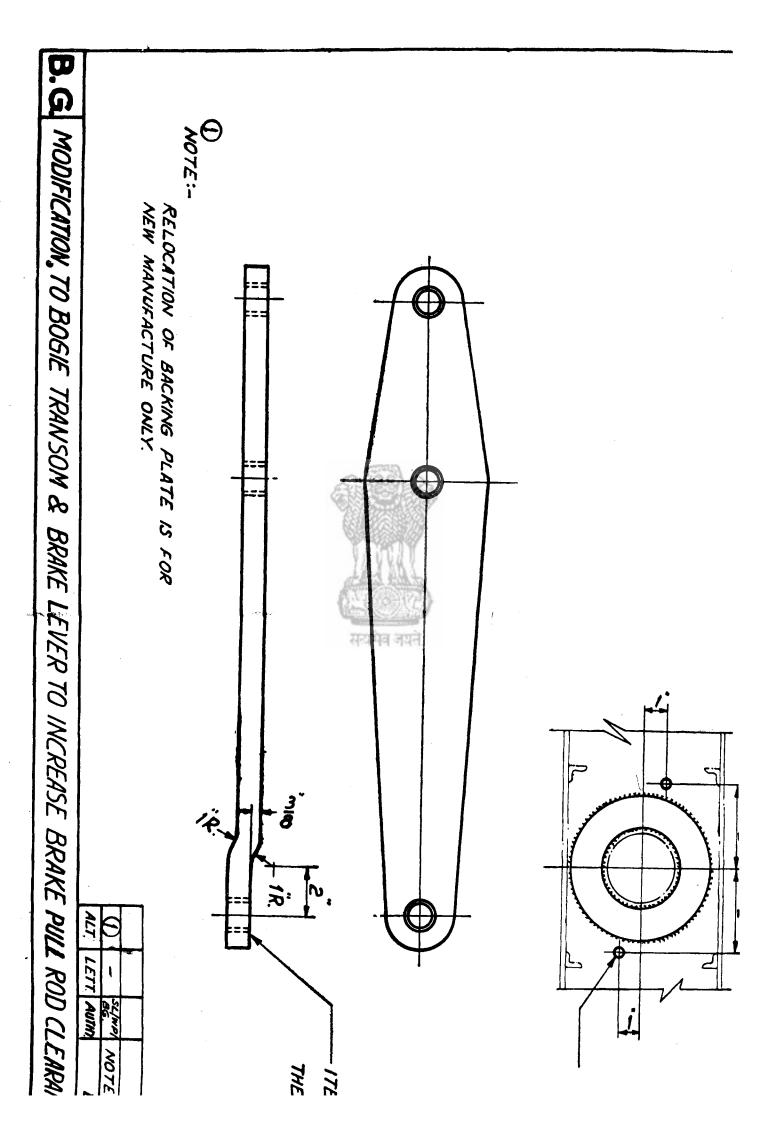


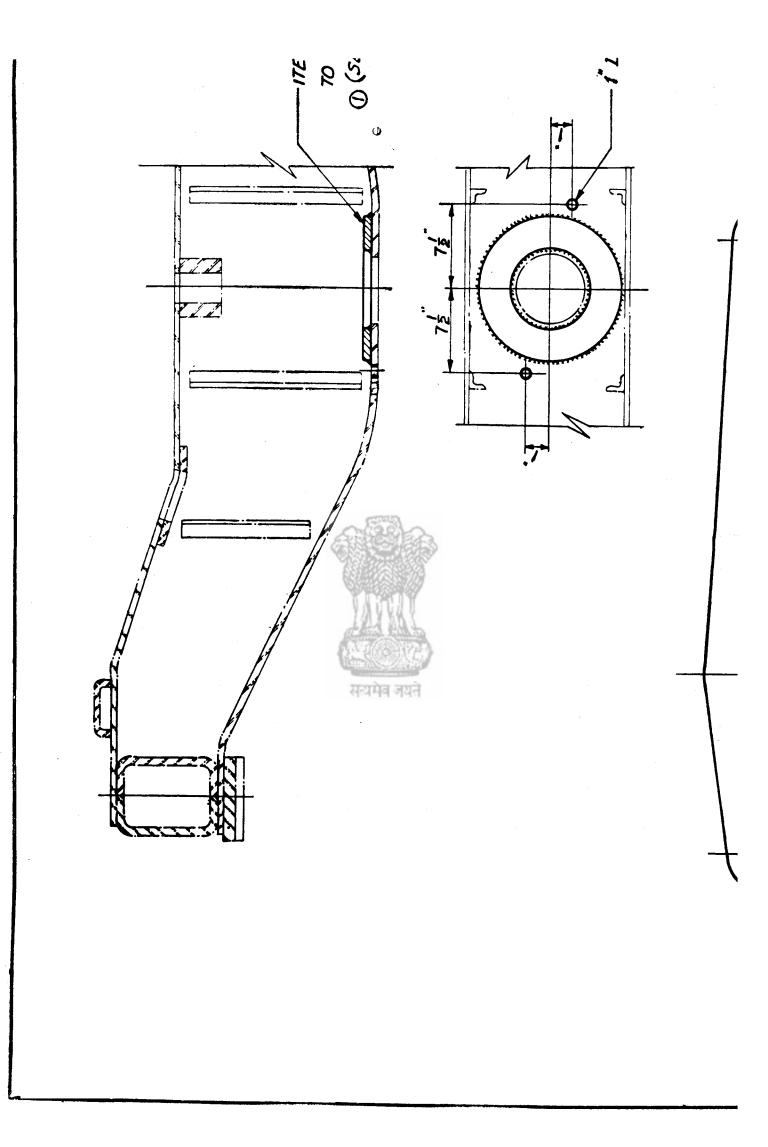


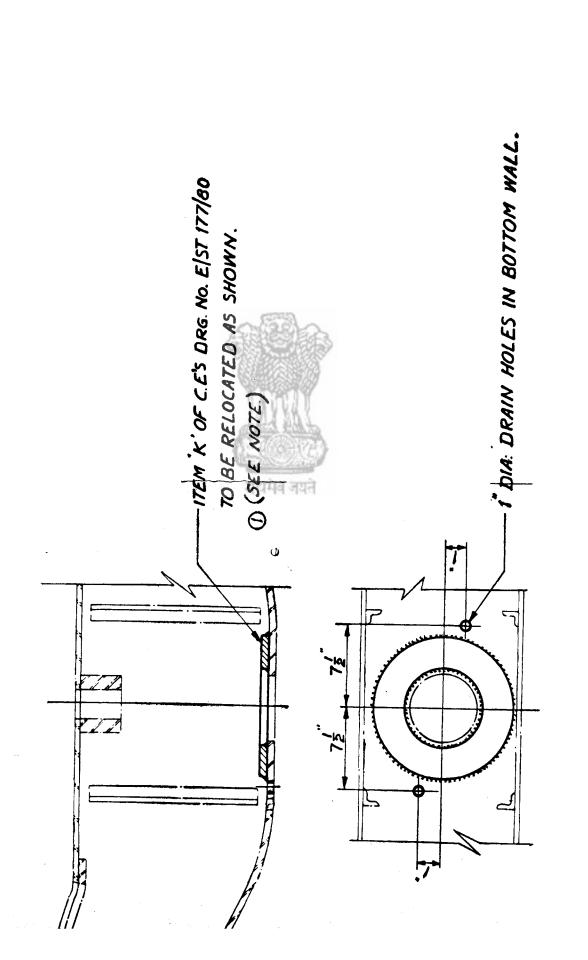


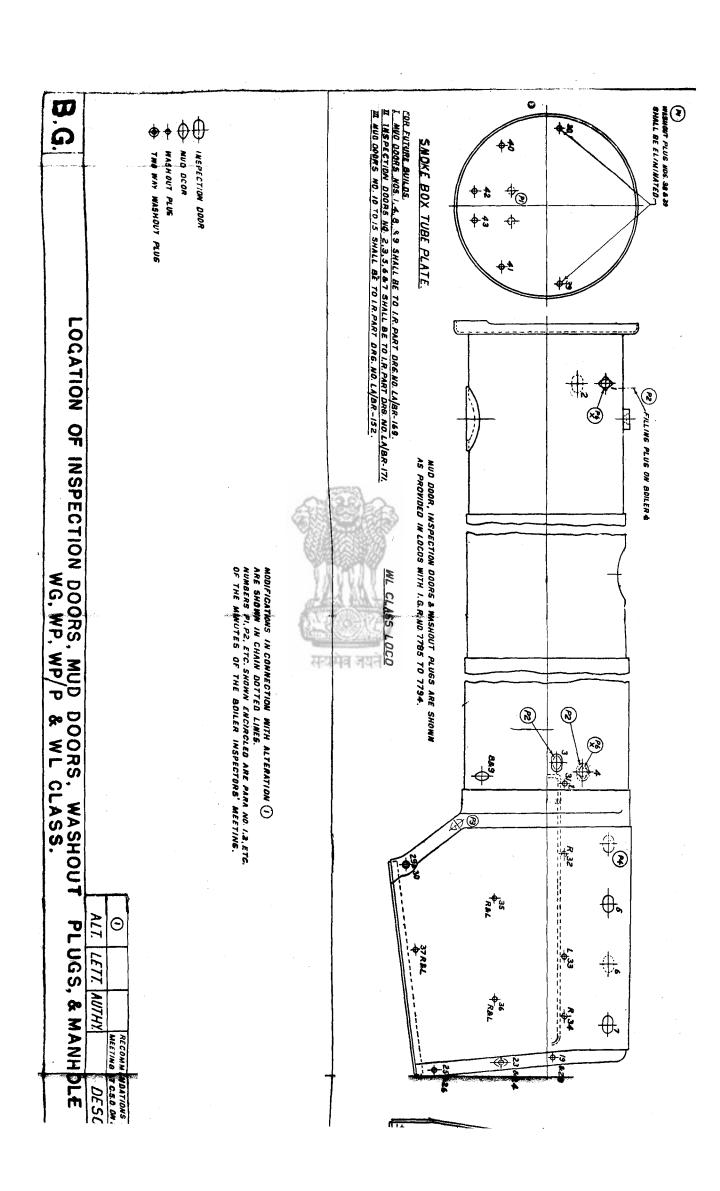


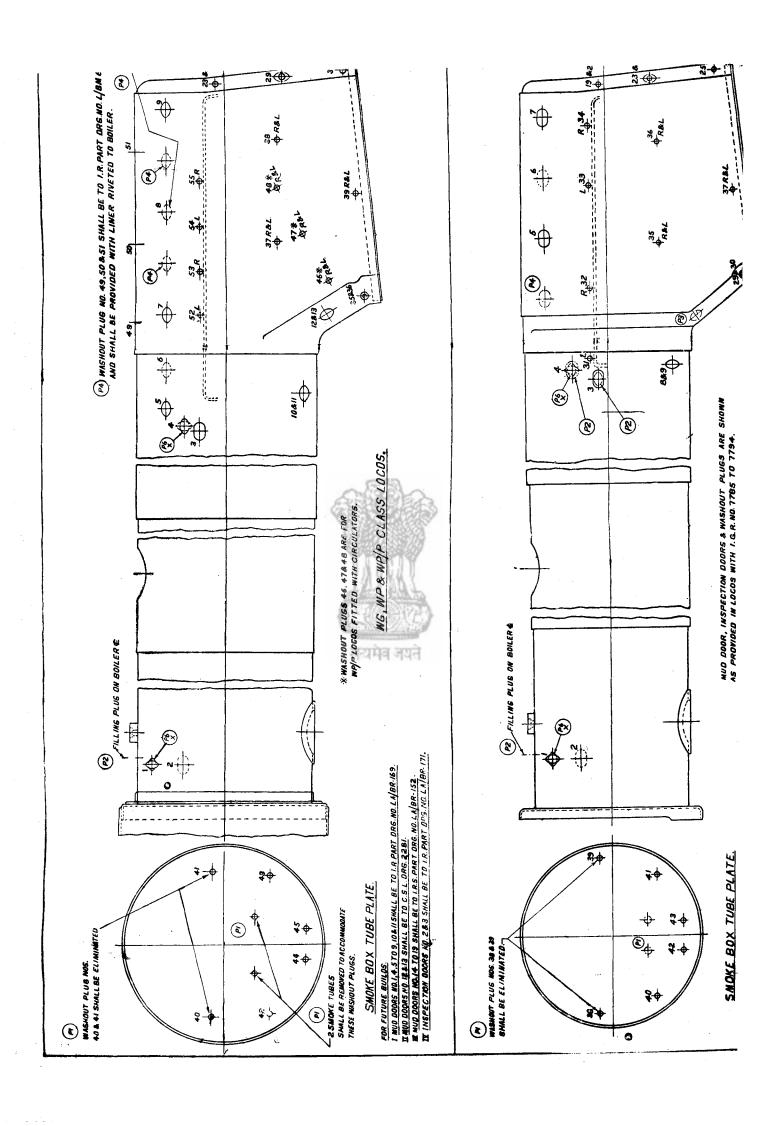


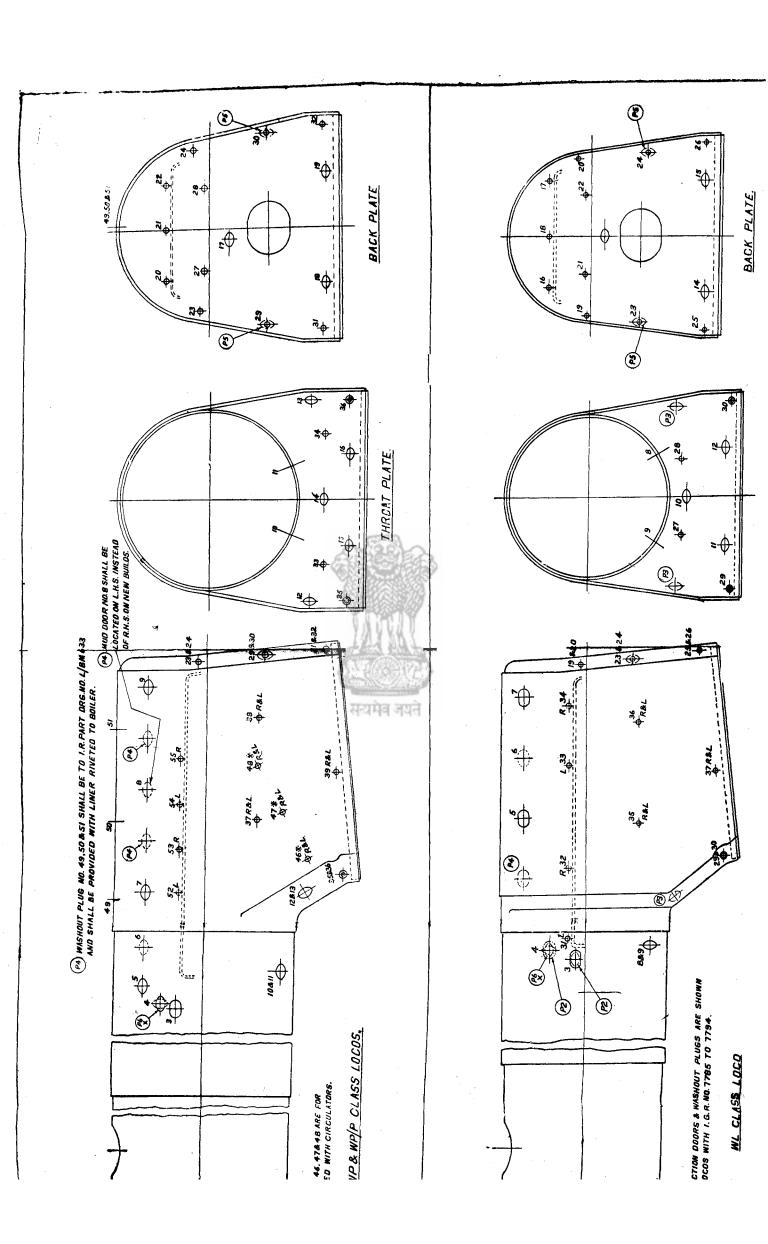


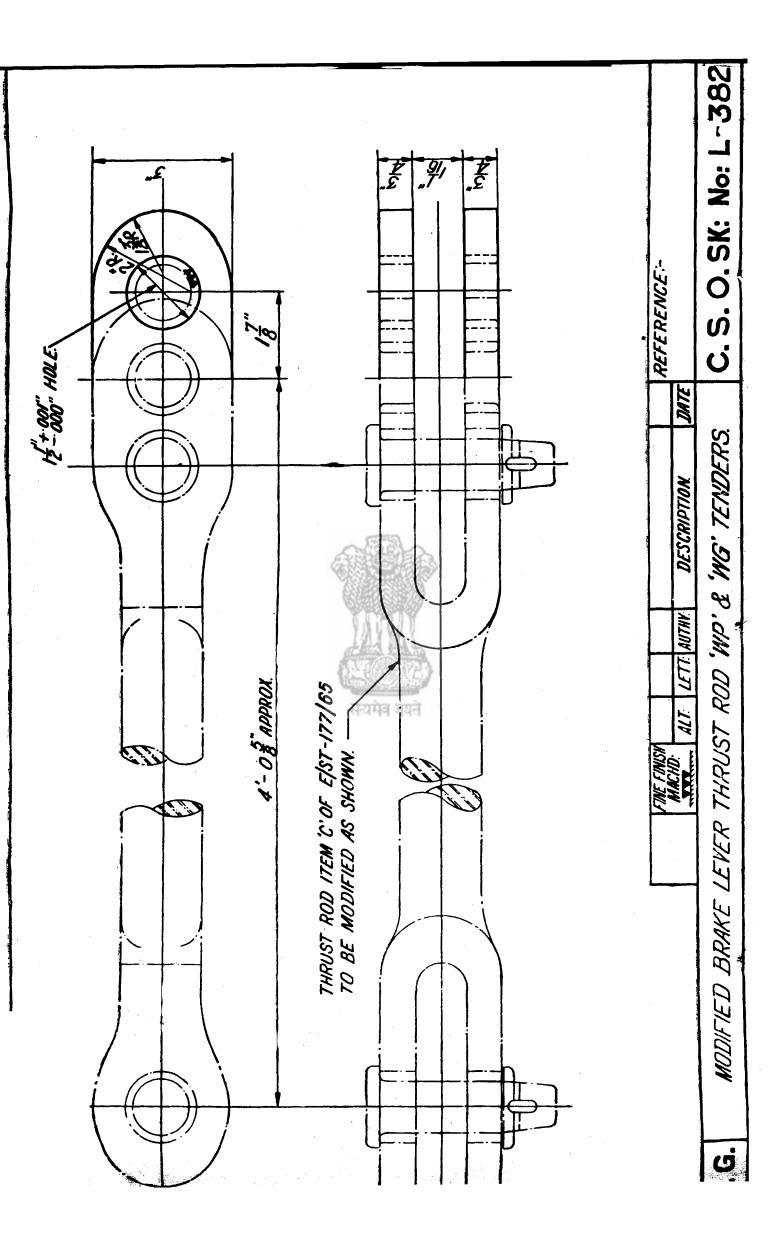


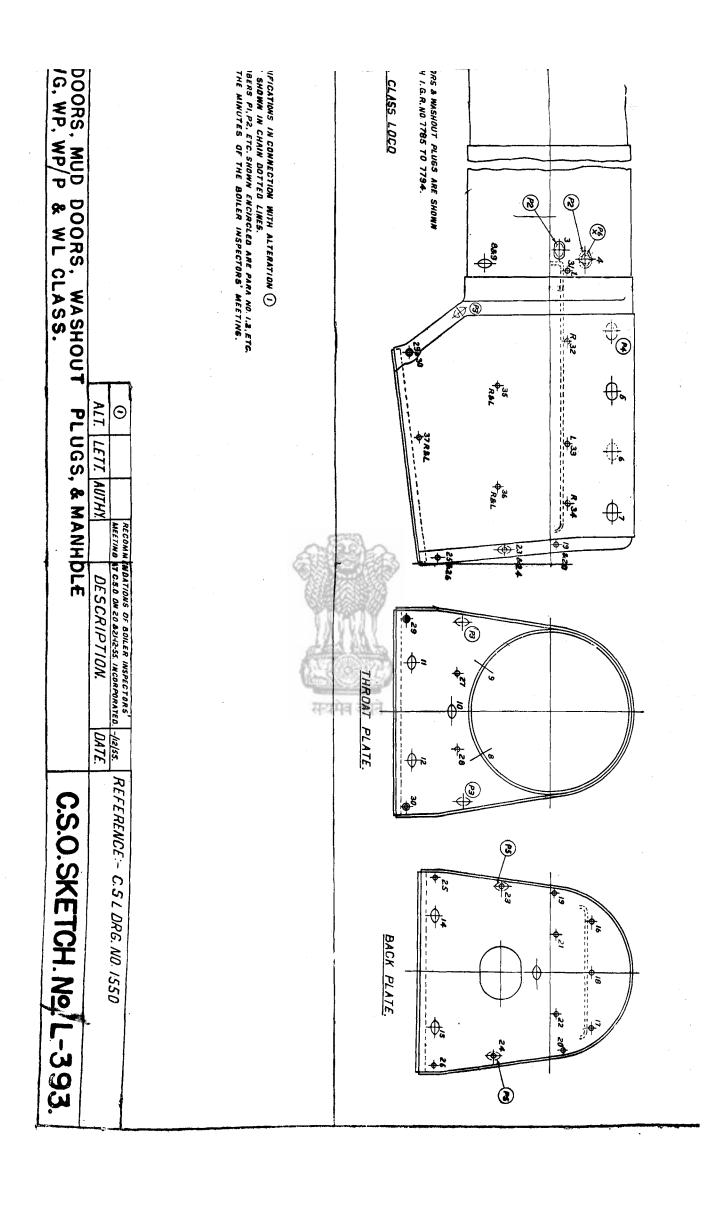


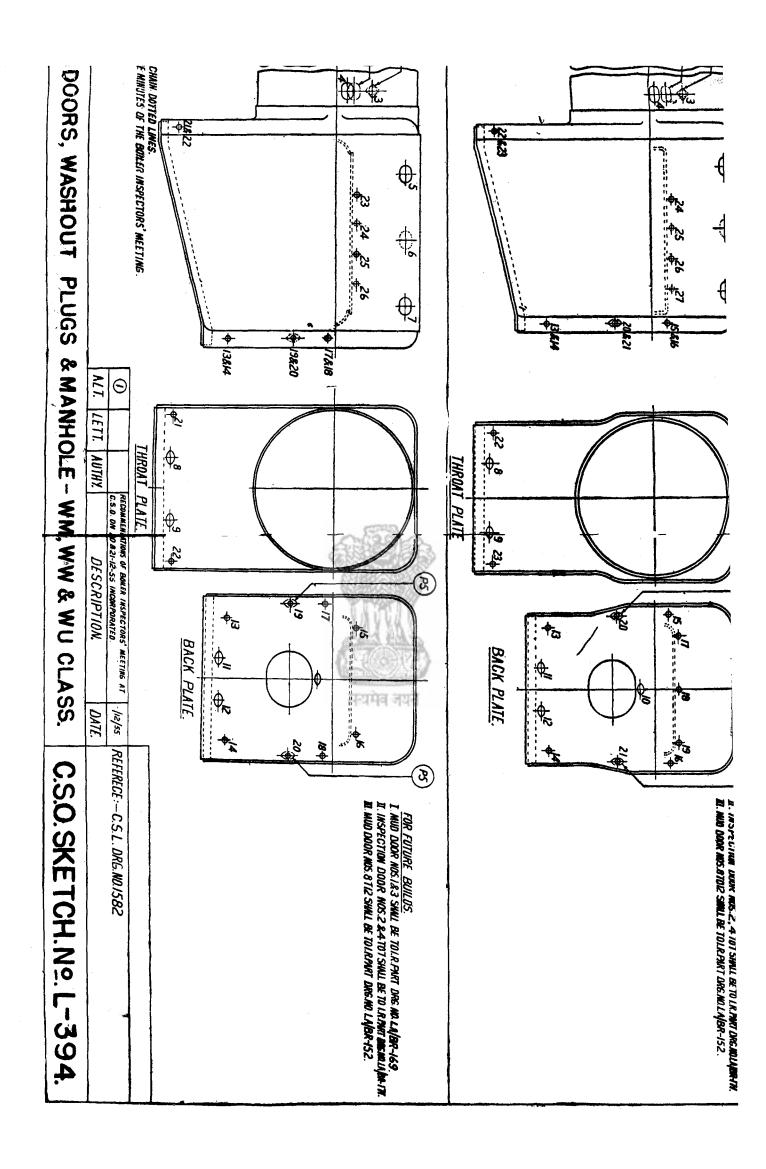


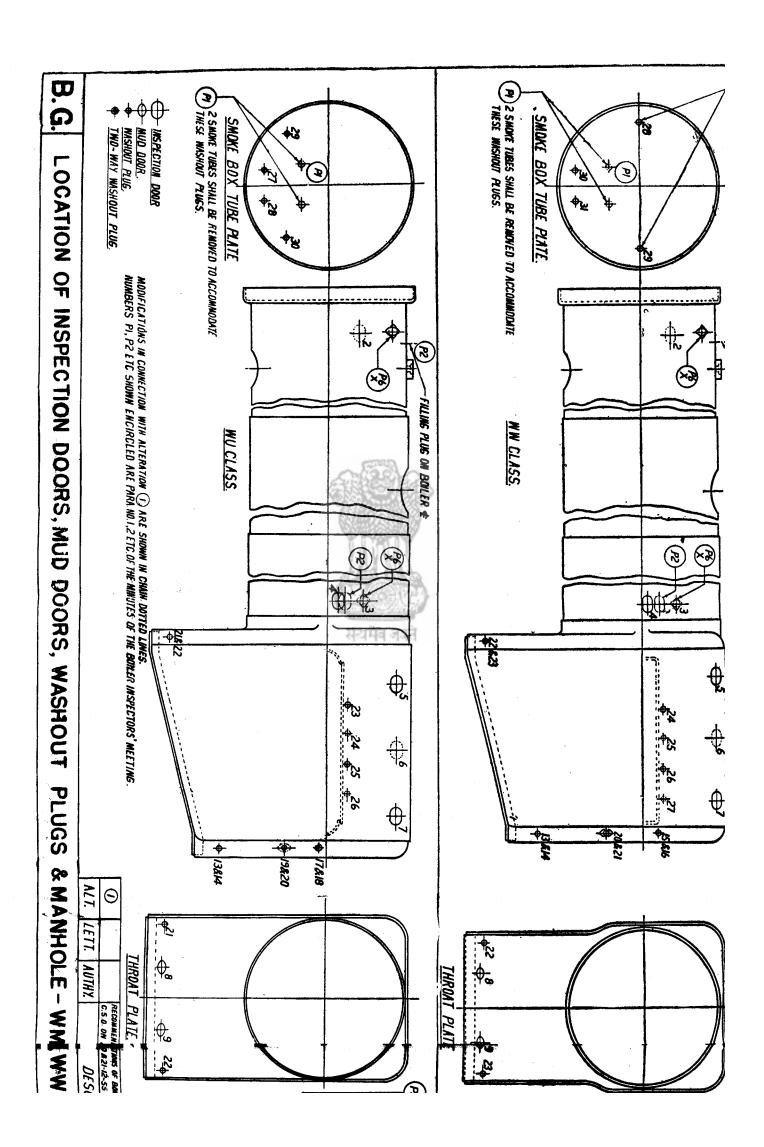


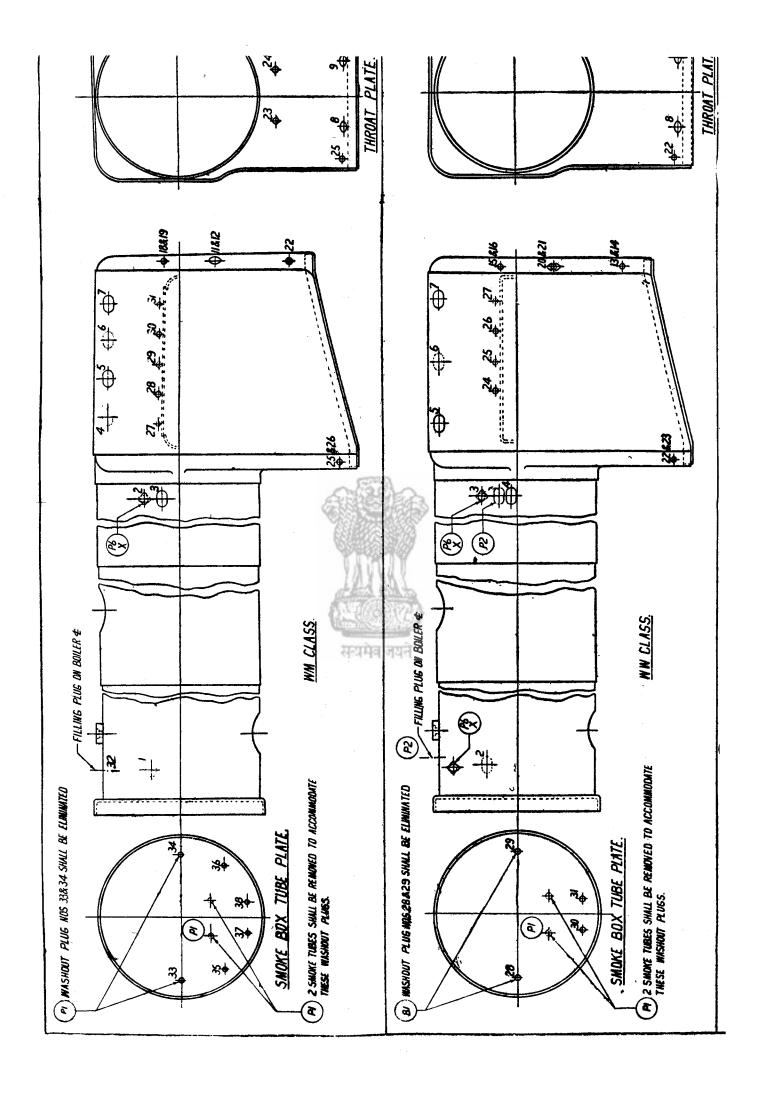


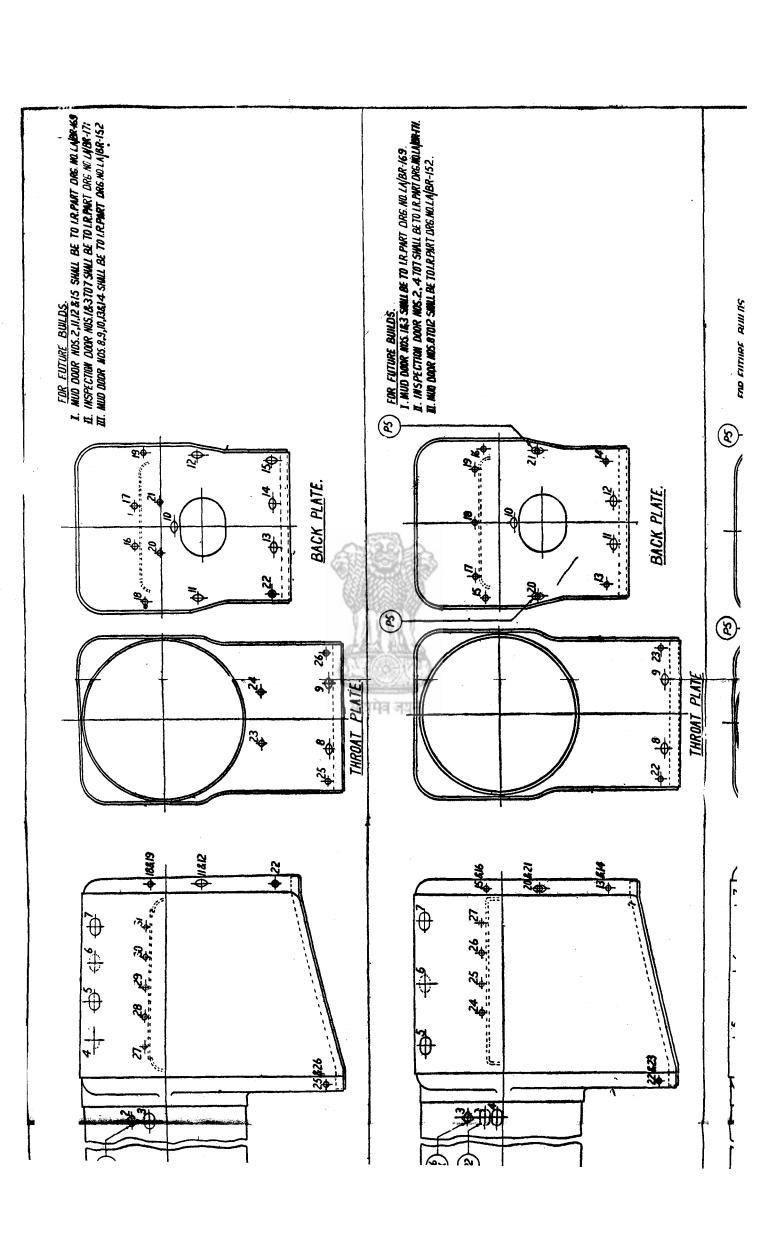


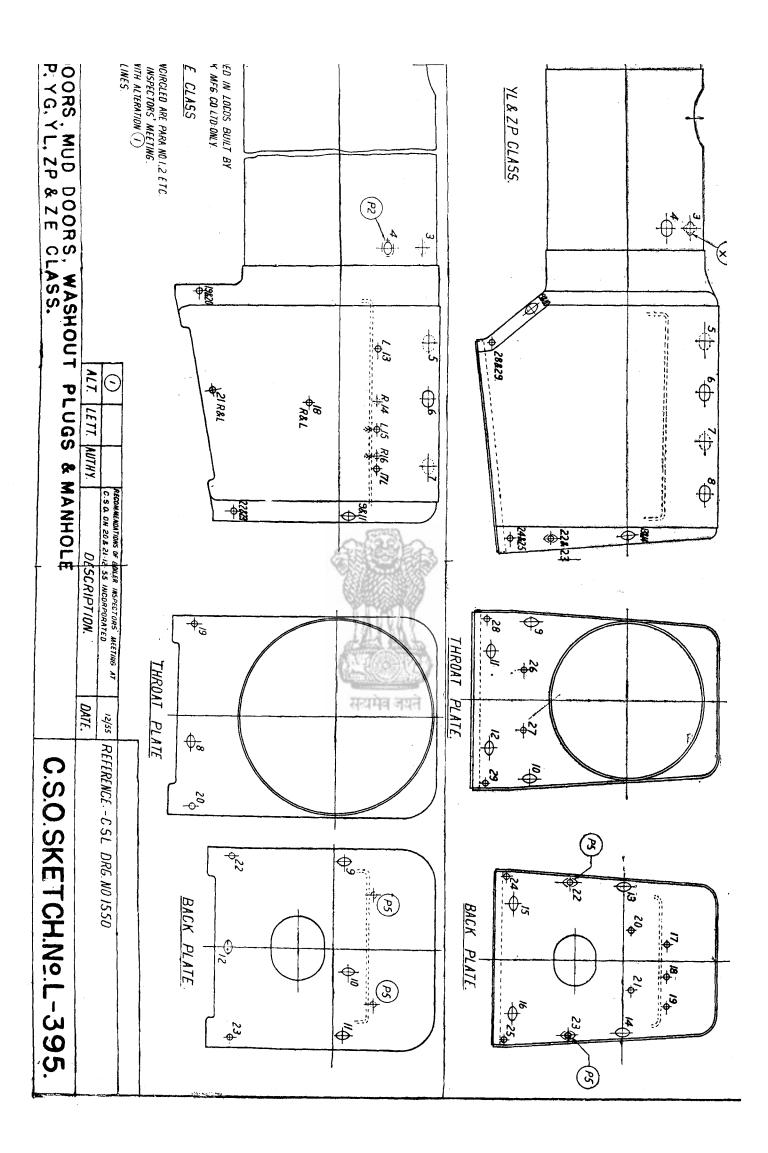


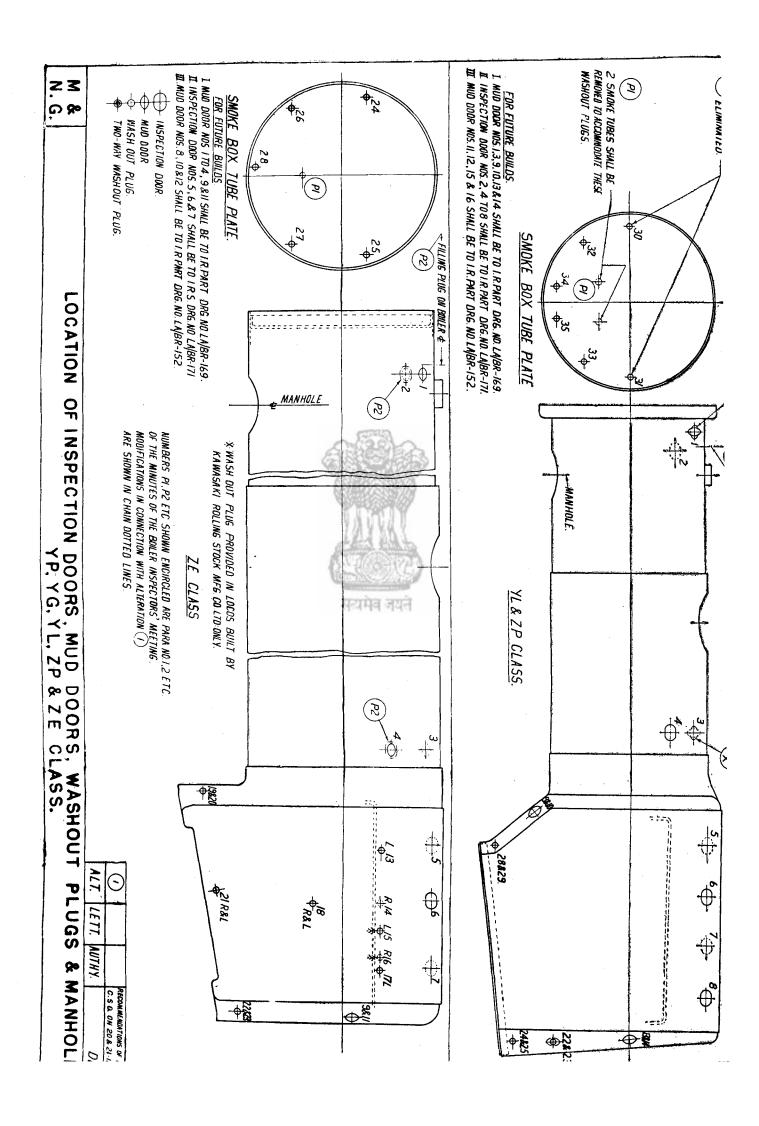


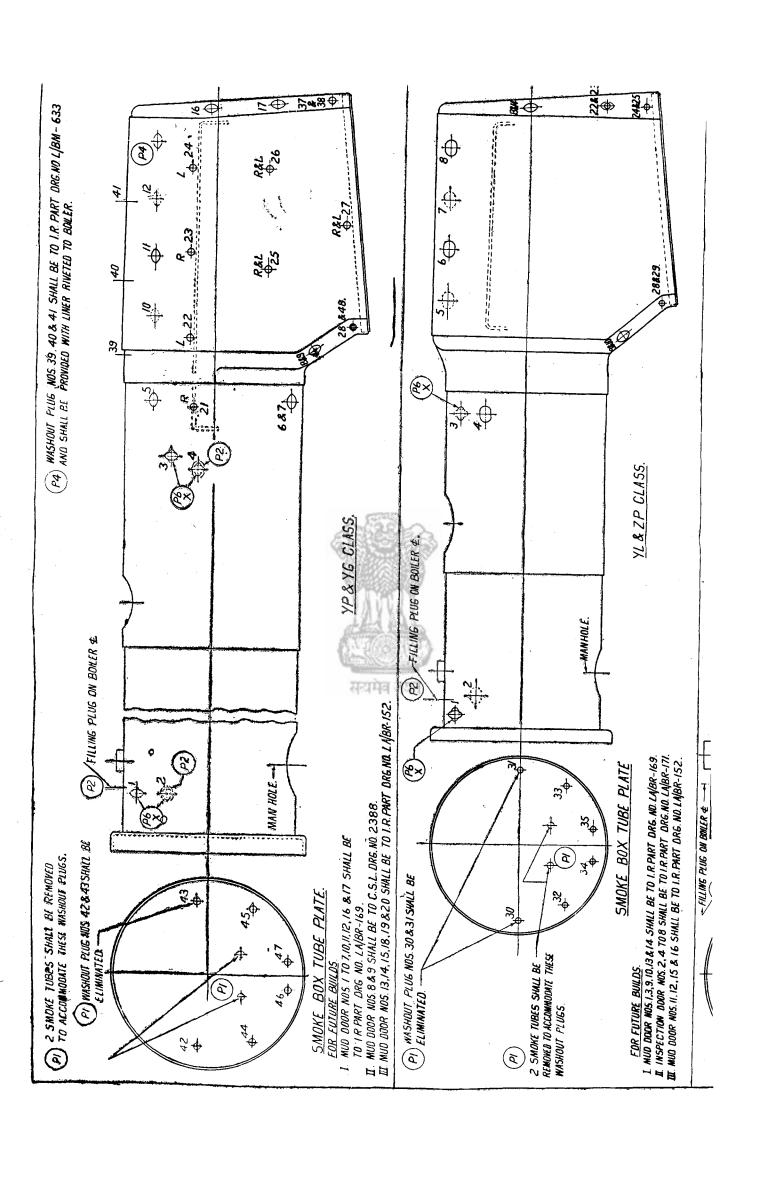


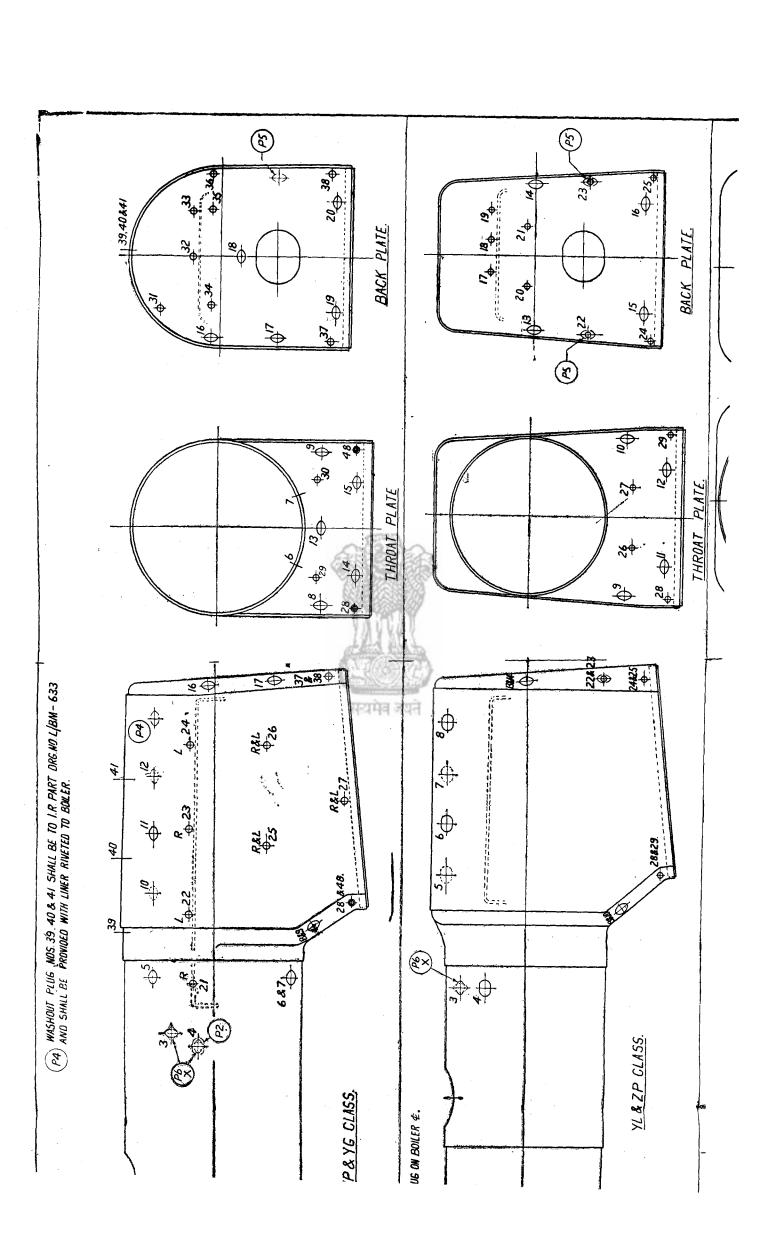


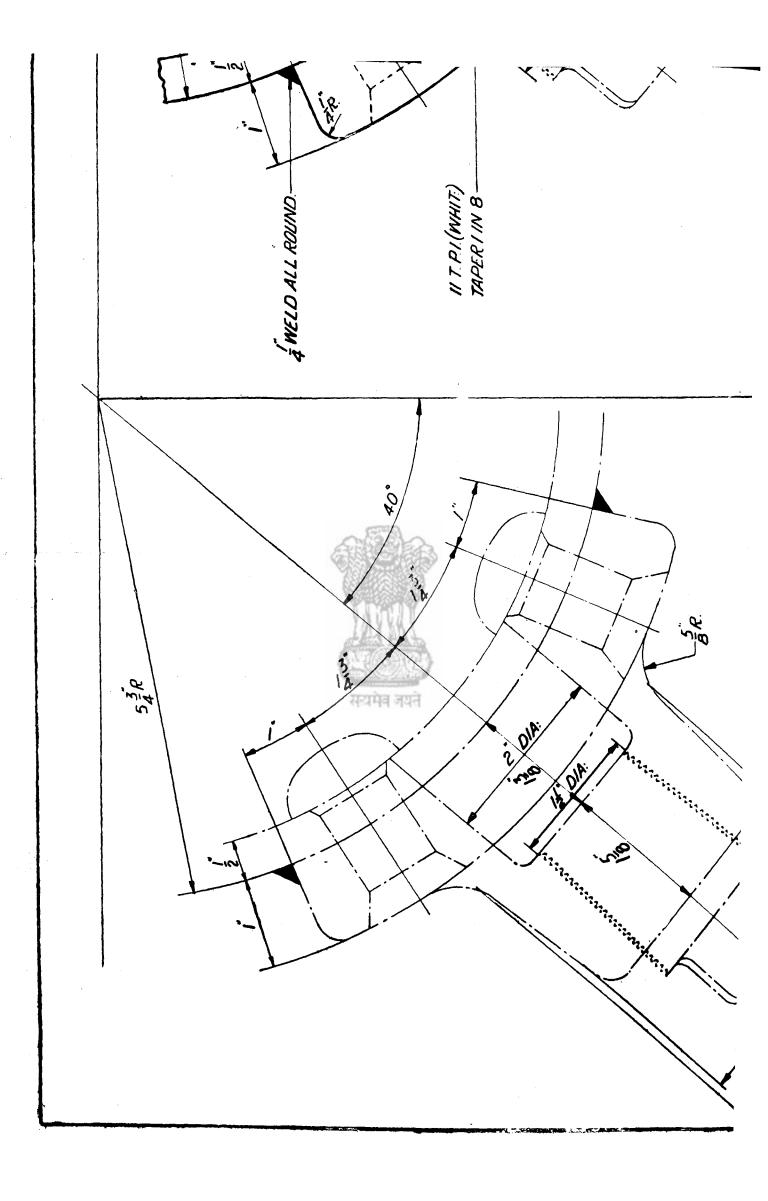


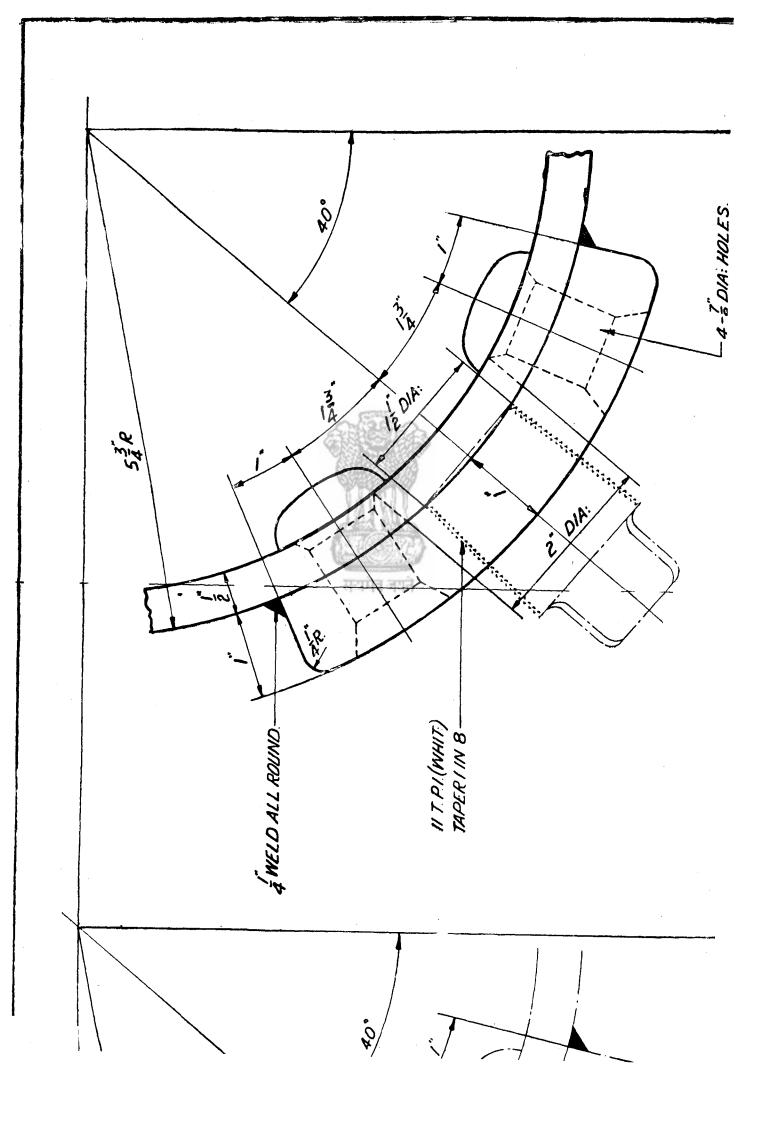


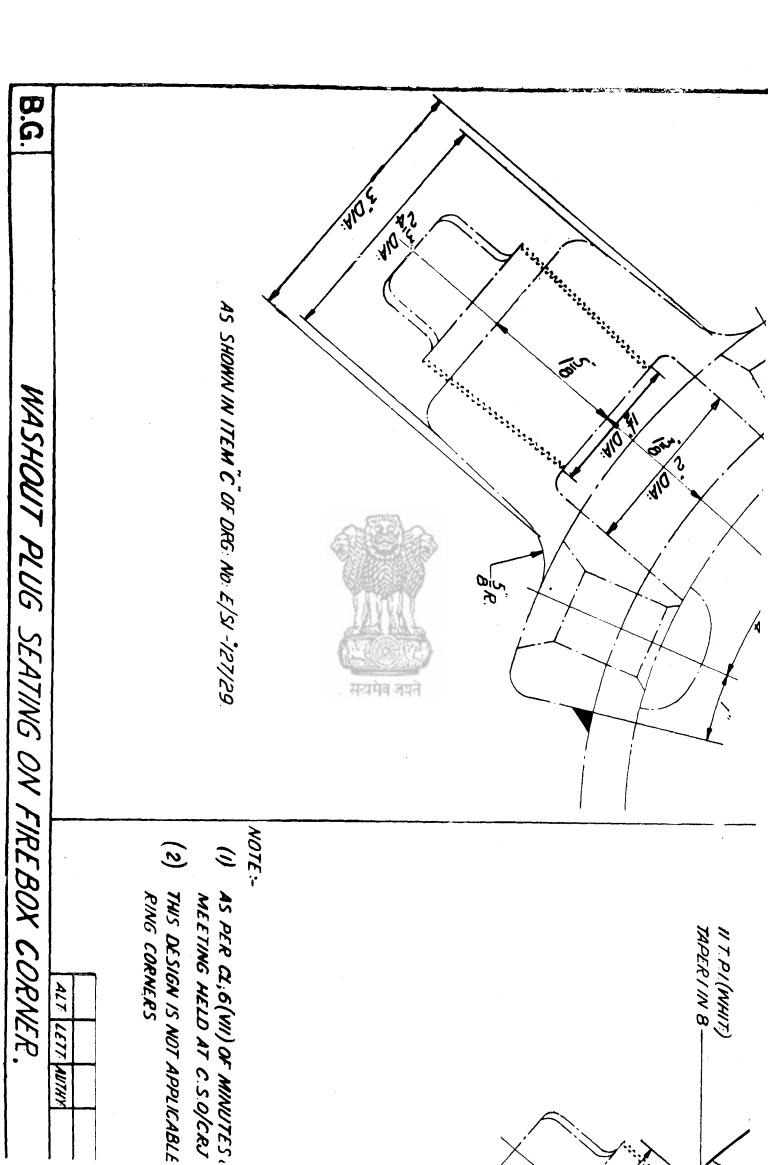


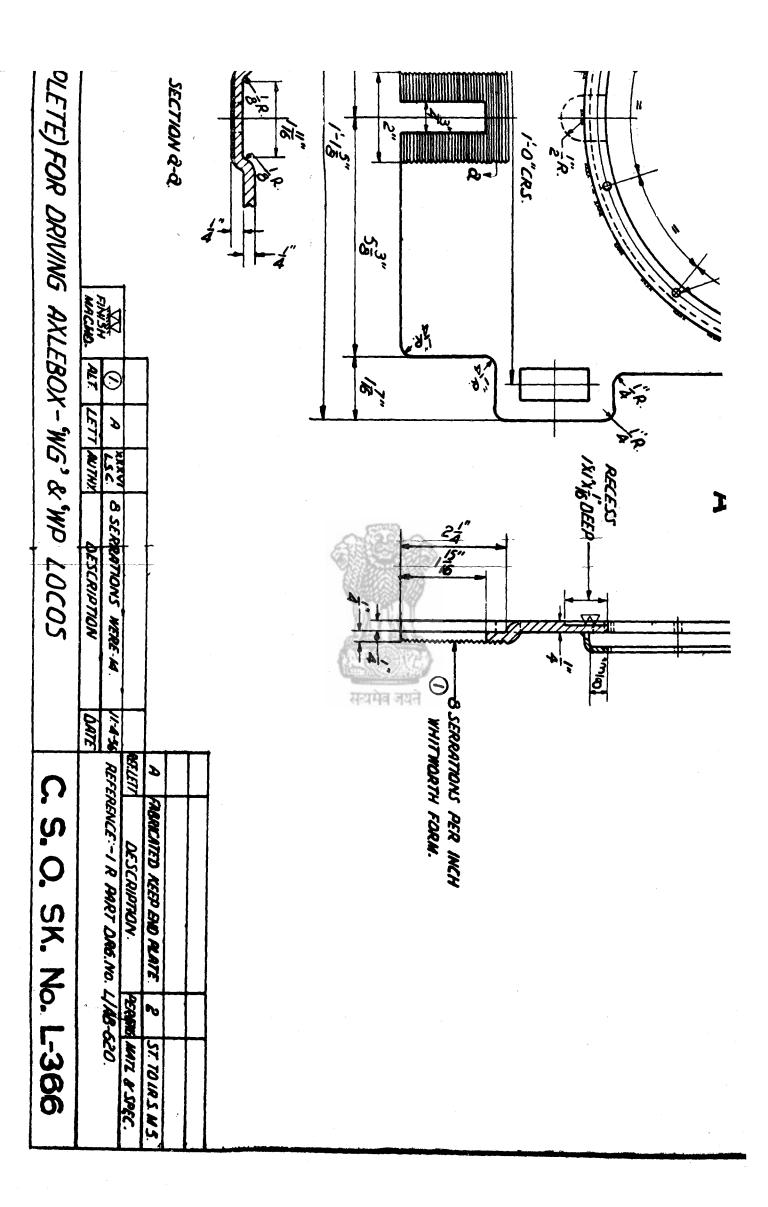


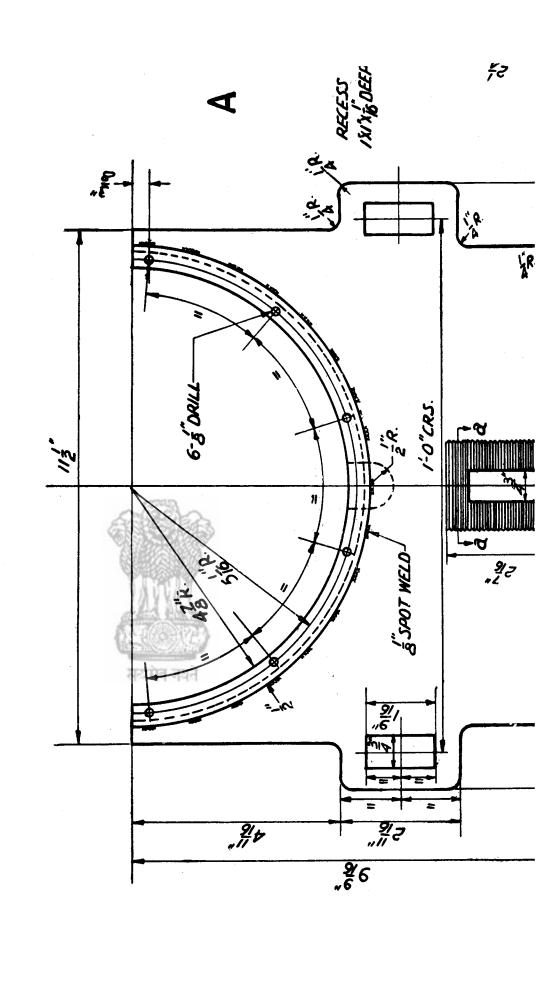


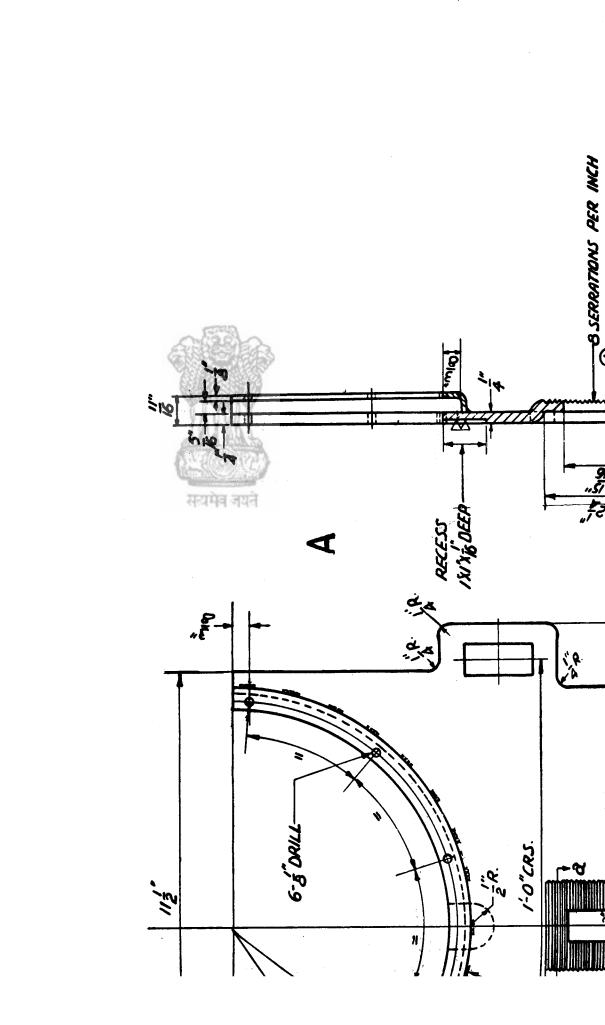


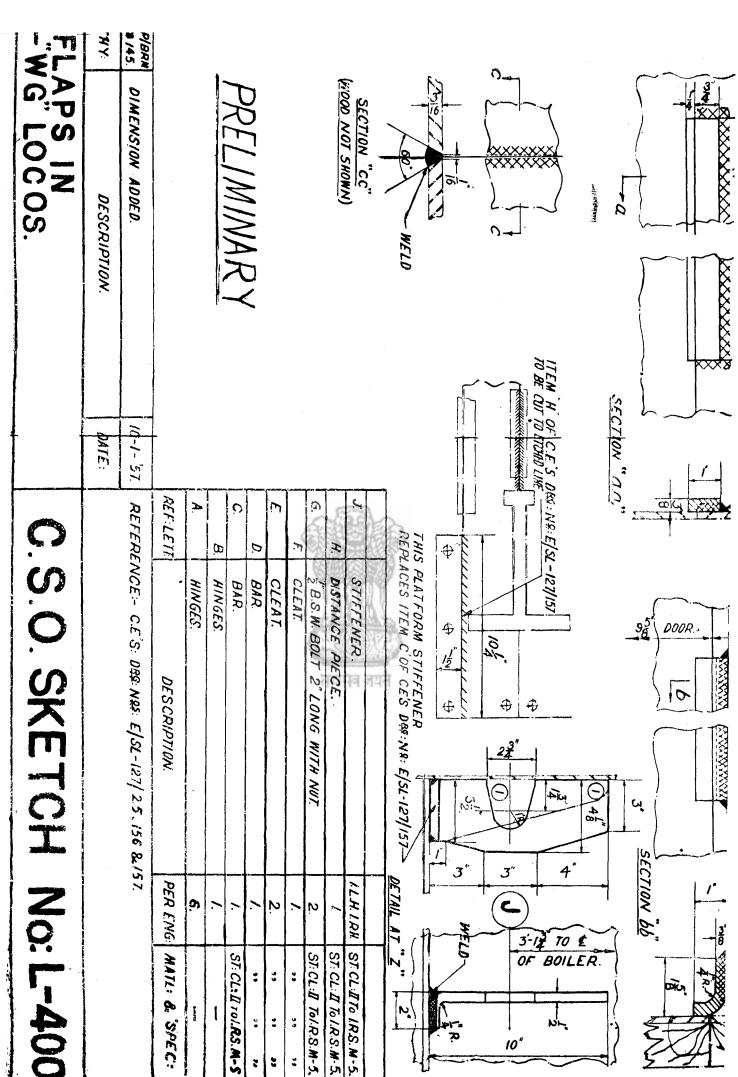












RETRACED & RENUMBERED AS C.S.L. DES MIST E.

